GE Energy

Proprietary Information Notice
This letter forwards proprietary information in accordance with 10CFR2.390. The balance of this letter may be considered non-proprietary upon the removal of Enclosure 2.

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MFN 06-189

Docket No. 52-010

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U.S. Nuclear Regulatory Commission
Document Control Desk
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Subject: **Response to Portion of RAI Letter Number 20 Related to ESBWR Design Certification Application – Seismic Design – RAI Numbers 2.5-1, 3.7-5, 3.7-7, 3.7-8, 3.7-11, 3.7-12, 3.7-25, 3.7-26, 3.7-29, 3.7-34, 3.7-52, and 3.7-55**

Enclosure 1 contains GE's response to the subject NRC RAIs transmitted via the Reference 1 letter. Enclosure 2 contains Validation Packages for computer codes used for the design and analysis of ESBWR Seismic Category I structures in response to RAI # 3.7-55.

Enclosure 2 contains proprietary information as defined in 10CFR2.390. The affidavit contained in Enclosure 3 identifies that the information contained in Enclosure 2 has been handled and classified as proprietary to GE. GE hereby requests that the proprietary information in Enclosure 2 be withheld from public disclosure in accordance with the provisions of 10 CFR 2.390 and 9.17. Enclosure 2 is entirely proprietary and, therefore, the Enclosure 2 cover sheet that lists the titles of the Validation Packages, represents the extent of available non-proprietary information.

If you have any questions about the information provided here, please let me know.

D068

Sincerely,

Kathy Sedney for

David H. Hinds
Manager, ESBWR

Enclosures:

1. MFN 06-189 - Response to Portion of NRC RAI Letter No. 20 Related to ESBWR Design Certification Application - Seismic Design - RAI Numbers 2.5-1, 3.7-5, 3.7-7, 3.7-8, 3.7-11, 3.7-12, 3.7-25, 3.7-26, 3.7-29, 3.7-34, 3.7-52, and 3.7-55
2. MFN 06-189 – Validation Packages - S/VTR-SD2, Validation Test Report for SSDP-2D, Rev. C, S/VTR-D3N, Validation Test Report for DAC3N, Rev. C, S/VTR-TEM, Validation Test Report for TEMCOM2, Rev. C – GE Proprietary Information
3. Affidavit – Louis M. Quintana – dated June 29, 2006

Reference:

1. MFN 06-115, Letter from U. S. Nuclear Regulatory Commission to Mr. David H. Hinds, *Request for Additional Information Letter No. 20 Related to ESBWR Design Certification Application,* April 24, 2006

cc:	WD Beckner	USNRC (w/o enclosures)
	AE Cubbage	USNRC (with enclosures)
	LA Dudes	USNRC (w/o enclosures)
	GB Stramback	GE/San Jose (with enclosures)
	eDRF	0000-0055-4350

ENCLOSURE 1

MFN 06-189

Response to Portion of NRC RAI Letter No. 20

Related to ESBWR Design Certification Application

Seismic Design

RAI Numbers 2.5-1, 3.7-5, 3.7-7, 3.7-8, 3.7-11, 3.7-12, 3.7-25, 3.7-26, 3.7-29, 3.7-34, 3.7-52, and 3.7-55

NRC RAI 2.5-1

The North Anna early site permit (ESP) site-specific Safe Shutdown Earthquake (SSE) spectra shown in DCD Tier 2, Figures 2.5-1 and 2.5-2 (DCD Pages 2.5-13 and 2.5-14) is not the final SSE approved by the staff for the North Anna ESP site. The final North Anna SSE for the ESP site incorporated site-specific amplifications (based on the local rock and soil properties) of both the horizontal and vertical ground motions as determined from the North Anna site controlling earthquakes. Please update the North Anna ESP SSE or justify the use of the North Anna ESP that does not include the local site effects.

GE Response

The spectra identified as "North Anna ESP – ESBWR CB Base" and "North Anna ESP – ESBWR RB/FB Base" in DCD Figures 2.5-1 and 2.5-2 are the high-frequency spectra computed exactly as they were for the North Anna Early Site Permit SSE but defined at control points corresponding to rock outcrop at the horizons of the control building and reactor/fuel building bases. These spectra are based on the same best estimate subsurface material properties model as the SSE at its higher control point at the top of competent rock. The same local site effects are included in each of these spectra.

See also responses to RAI 3.7-7 and 3.7-11.

No DCD changes will be made in response to this RAI.

NRC RAI 3.7-5

In DCD Section 3.7.1, the applicant stated that seismic design parameters (including seismic ground motion response spectra) considered for the ESBWR seismic design comprise two site conditions, generic and North Anna early site permit (ESP) sites. It is not clear from the descriptions provided in DCD Section 3.7.1 if the intent of the DCD is to show that (a) the design is appropriate for the North Ana site and any other generic site for which the RG 1.60 response spectrum is the appropriate SSE; or (b) if the design is to be considered appropriate for any site whose design response spectrum falls below the envelope of the RG 1.60 and North Anna design spectrum. The applicant also stated on Page 3.7-1, that the SSE is based upon an evaluation of the maximum seismic potential at a site. The DCD indicates that the results from the two separate ground motion sets are considered in the plant evaluations and development of enveloped responses. If the envelope spectrum were to be specified as the SSE, then a single set of time histories appropriate for this envelope spectrum would be used to generate enveloped responses. The staff requests the applicant clarify the definition of the SSE being used for the plant design, and also justify that the enveloped responses from load cases using multiple time histories (generic and North Anna) in fact leads to a conservative result of responses that would be obtained from a single ground motion time history (envelope of generic and North Anna ESP sites).

GE Response

To demonstrate the conservatism in the existing analysis results using two separate input motions, GE is currently developing a single set of three orthogonal, statistically independent time histories that match the single envelope target response spectra of 5% damping shown below:

Horizontal		Vertical	
Frequency (Hz)	Sa (g)	Frequency (Hz)	Sa (g)
0.1	0.023	0.1	0.015
0.25	0.141	0.25	0.094
2.5	0.939	3.5	0.894
9	0.783	9	0.783
10	0.92	10	0.724
20	1.35	20	1.11
30	1.35	30	1.24
50	1.1	50	1.21
100	0.5	100	0.5

The target response spectra envelop 0.3g RG 1.60 and North Anna ESP site-specific spectra. The spectral values up to and including 9 Hz and 10 Hz in the horizontal and vertical directions, respectively, are based on 0.3g RG 1.60 spectra. At higher frequencies

the spectral values closely match that of the envelope of North Anna ESP spectra at ESWBR RB/FB and CB foundations described in DCD Section 3.7.1.1.3.

Additional analysis using the single envelope target spectrum compatible time histories will be performed. The results will be compared with the existing analysis and the existing site envelope responses modified if they are exceeded. Details will be provided to the NRC by August 18, 2006.

DCD Tier 2 Table 2.0-1, Section 2.5.2, Figure 2.5-1, Figure 2.5-2, and Section 3.7.5.1(1) will be revised in the next update as noted in the attached markups. Similar changes will be made to DCD Tier 1 Table 5.1-1, Figure 5.1-1 and Figure 5.1-2 in the next update as noted in the attached markups.

NRC RAI 3.7-7

In DCD Section 3.7.1, the applicant stated that because the Clinton and Grand Gulf site conditions are bounded by the envelope of the generic site and North Anna site conditions, the North Anna ESP site is selected for further consideration in conjunction with generic sites for site enveloping seismic design of the ESBWR standard plant. In addition to the ground motion response spectra, and time histories provided in the DCD, the applicant is requested to include in the DCD a detailed description of the North Anna site conditions (e.g., geotechnical properties), including response spectra at various depths through the profile consistent with design spectra.

GE Response

Site Description and Rock Properties

The North Anna site is located within the Piedmont Upland section of the Piedmont Physiographic Province. It is situated approximately 15 miles west of the Fall Line boundary between the Piedmont and Coastal Plain Physiographic Provinces. The site is bordered by Lake Anna to the north and east, and to the south and west by forest and brushwood-covered land interspersed with an occasional farm. The area is well dissected by streams with the inter-stream divides being generally fairly wide and sloping or rolling. Some of the divides become steeper along the lower tributaries of the larger streams, and along these tributaries entrenchment has been rapid.

The topography in the site region is characteristic of the Piedmont Upland section, with a gently undulating surface varying in elevation from about 200 to 500 feet. The slopes in the region typically range from 2 to 5 percent, with steeper slopes along the lower tributaries of some of the larger streams ranging from 7 to 10 percent.

At the site itself, site grade for the existing units is at an approximate elevation of 271 feet. The ground surface generally rises to the west and south to elevations of over 300 feet.

The North Anna subsurface materials can be divided into five zone categories:

I	Residual clays and clay silts – all structure of parent rock is lost
IIA	Saprolite – core stone less than 10% of volume of overall mass
IIB	Saprolite – core stone 10 to 50% of volume of the overall mass
III	Weathered rock – core stone more than 50% of volume of the overall mass
IV	Parent bedrock – slightly weathered to fresh rock

These zones have worked as a successful means for classifying the soil and rock with regard to engineering properties. This zone system was used in the UFSAR for the existing units and was also used in the ESP SSAR. An additional zone, termed Zone III-IV, has been adopted to represent slightly-to-moderately weathered rock.

The reactor, fuel, and control buildings will be founded on Zone IV or on Zone III-IV bedrock. The materials overlying this bedrock exhibit a continuously more pronounced form of in-place weathering. Zones I, II and III will be removed during construction and are not relevant to the response analysis for dynamic loading of the reactor, fuel, and control buildings. Thus, only the properties of the Zone III-IV and Zone IV bedrock as they relate to dynamic analysis are presented below.

Bedrock at the site is made up of rock from the Ta River Metamorphic Suite, which extends to several thousand feet depth. The Zone IV bedrock is fresh to slightly weathered gneiss. Gneiss is a metamorphic rock that exhibits a banded texture (foliation) in which light and dark bands alternate. It is composed of feldspar, quartz, and one or more other minerals such as mica and hornblende. The ESP investigation described the bedrock as a quartz gneiss with biotite (a dark mica) in the majority of cores, but also referenced biotite quartz gneiss and occasionally biotite gneiss. The top of Zone IV (including Zone III-IV) bedrock encountered in the borings made at the ESP site range from Elevation 188 feet to 298 feet.

Table 3.7-7 (1) shows the static and low-strain dynamic properties of Zones III-IV and IV based on analysis and evaluation of extensive field and laboratory test data.

Table 3.7-7 (1) - Bedrock Properties

Stratum	Zone III-IV	Zone IV
	Slightly to Moderately Weathered Quartz Gneiss w/Biotite	Fresh to Slightly Weathered Quartz Gneiss w/Biotite
Recovery, %	90	100
RQD, %	50	95
Unconfined compressive strength, ksi	4	12
Total unit weight, pcf	163	163
Shear wave velocity, ft/sec		
Range	2,500 to 4,500	4,000 to 8,000
Best estimate	3,300	6,300
Comp. wave velocity, best est., ft/sec	7,400	14,000
Elastic modulus, ksi	1,000	3,750
Shear modulus, ksi	375	1,400
Poisson's ratio	0.33	0.33
Coeff. of sliding against concrete	0.65	0.7

For the response of rock to dynamic loading, some additional material properties were derived. For the SHAKE analysis for the powerblock area, the profile assumed grade at El. 271 ft (grade of existing units) with top of competent material at El. 250 ft. The definition of competent material was a shear wave velocity, Vs = 3,300 ft/sec, the best estimate of shear wave velocity for the Zone III-IV material. Based on extrapolation of geophysical data obtained for the existing units, shear wave velocity for hard rock (Vs = 9,200 ft/sec) was assumed to occur at about 160 ft below grade (about El. 110 ft). Assuming a linearly increasing shear wave velocity profile between top of competent material and hard rock, the estimated shear wave velocity at the bottom of the ESBWR reactor building/fuel building basemat at about 66 ft depth (El. 205 ft) was about 5,200 ft/sec, and the estimated shear wave velocity at the bottom of the control building basemat at about 49 ft depth (about El. 220 ft) was about 4,500 ft/sec. These values are shown on Table 3.7-7 (2).

For the Zone III-IV and Zone IV bedrock, the shear modulus and shear wave velocity values shown in Table 3.7-7 (1) and the shear wave velocity values shown in Table 3.7-7 (2) were taken as constant throughout the strain range normally covered in the SHAKE analysis (i.e., non strain dependent). The SHAKE analysis used a constant 2% damping ratio (i.e., non strain dependent) for this bedrock.

Response Spectra

In the course of North Anna Early Site Permit calculations, response spectra were developed at five elevations as summarized in Table 3.7-7 (2).

Table 3.7-7 (2) - Description of the Rock Horizons of Interest

Description	Depth below top of competent rock (feet)	Approximate Shear Wave Velocity (ft/sec)
Top of competent rock [Zone III-IV]	0	3,300
Proposed location of base of control building	30	4,500
Proposed location of base of reactor/fuel buildings	45	5,200
Best estimate, Zone IV	~70	6,300
Input of very hard rock time histories	~140	9,200

The horizontal North Anna Early Site Permit Safe Shutdown Earthquake spectrum is defined at the top of competent rock horizon and is shown in Figure 2.5-55A of the ESP SSAR. The horizontal target spectra for the ESBWR control building and reactor/fuel building are shown as solid light gray lines in DCD Figures 3.7-24, 3.7-26, 3.7-30, and 3.7-32. These spectra and spectra for the deeper horizons of Table 3.7-7 (2) are all shown in Figure 3.7-1 (1). All spectra are for "outcrop" motions at the free ground surface.

The vertical North Anna Early Site Permit Safe Shutdown Earthquake spectrum is defined at the top of competent rock horizon and is also shown in Figure 2.5-55A of the ESP SSAR. The vertical target spectra for the ESBWR control building and reactor/fuel building are shown as solid light gray lines in DCD Figures 3.7-28 and 3.7-34. The vertical spectra at these and the additional horizons of Table 3.7-7 (2) and Figure 3.7-7 (1) differ from each other in a very similar manner to the horizontal spectra, and are not plotted here.

No DCD changes will be made in response to this RAI.

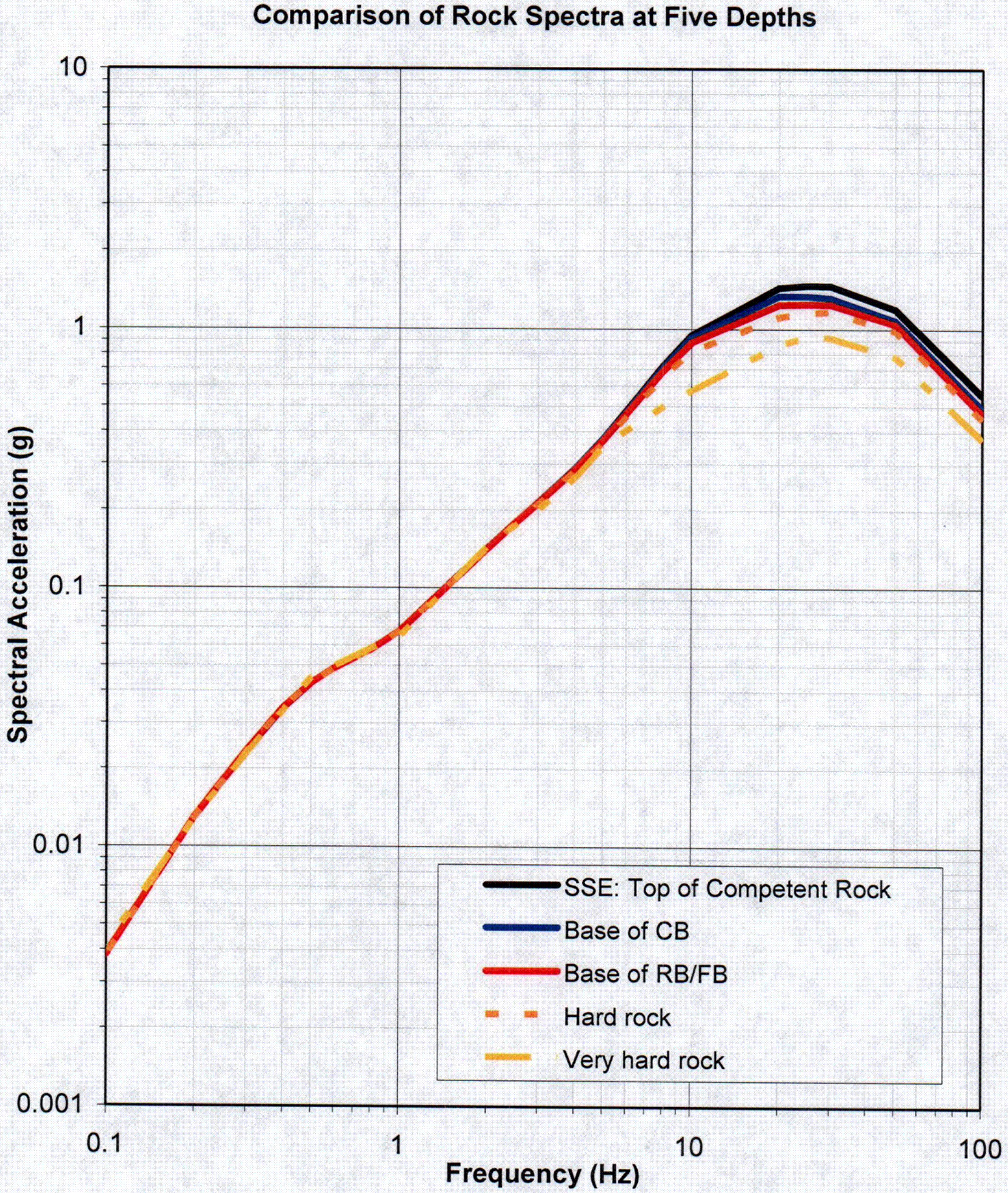


Figure 3.7-7 (1) - Horizontal "outcrop" ground motion spectra for the SSE, CB, RB/FB, and two deeper horizons.

NRC RAI 3.7-8

In DCD Section 3.7.1.1 and DCD Section 3.7.1.1.1, respectively, the applicant stated that for generic site (1) the peak ground acceleration (PGA) of the SSE is 0.3g at the foundation level, and (2) the design response spectra are specified at the foundation level in the free field. It is the staff's understanding that the foundation level of the reactor/fuel building is located at 20m (66.0 ft) below grade and the foundation level of the control building is located at 15.05 m (49ft) below grade. The applicant is requested to provide its technical basis to justify why the PGAs and ground response spectra are the same at these two (2) different foundation elevations.

GE Response

The use of the same 0.3g RG 1.60 spectra at different foundation elevations is a conservative approach for developing enveloping seismic loads for the ESBWR standard plant design. In COL a site-specific SSE probabilistic site response analysis will be performed and the resulting free-field outcrop spectrum at the foundation level of each Seismic Category I building will be compared to the ESBWR standard plant design spectrum as stated in the response to RAI 3.7-5.

Please note that the embedment depths are 20m for the reactor and fuel buildings and 14.9m for the control building. DCD Section 3.7.1.1.3, Table 3.8-13, and Table 3A.2-1 will be revised in the next update as noted in the attached markup.

NRC RAI 3.7-11

In the fourth sentence of the first paragraph of DCD Section 3.7.1.1.3 (Page 3.7-4), the applicant stated that, since the low frequency part of North Anna SSE ground response spectra are enveloped by the 0.3g RG 1.60 generic site response spectra with large margins, only the high frequency part needs to be explicitly taken into account. The staff requests the applicant to provide justifications for the conclusion drawn in the DCD and a comparison plot of these two sets of ground response spectra in Tier 2 DCD Section 3.7.1, "Seismic Design Parameters."

GE Response

The spectra of Figure 3.7-7 (1) are the envelops of high and low frequency target spectra used to define outcrop ground motions at horizons within the site rock profile. Figure 3.7-11 (1) reproduces the CB and RB/FB spectra of Figure 3.7-7 (1) and adds RG 1.60 anchored to a PGA of 0.3g. Comparison of this figure with DCD Figure 2.5-1 implies that the high frequency target spectra (shown in DCD Figure 2.5-1) control motions for frequencies above about 2 Hz, and that the low frequency target spectra (enveloped by the low frequency part of the spectra in Figure 3.7-7 (1) above) control motions for lower frequencies. It is apparent that the RG 1.60 spectrum envelopes by a factor of over 5 the low frequency part of the site-specific ground motion spectra for all evaluated North Anna Early Site Permit horizons (including the CB and RB/FB base horizons).

No DCD changes will be made in response to this RAI.

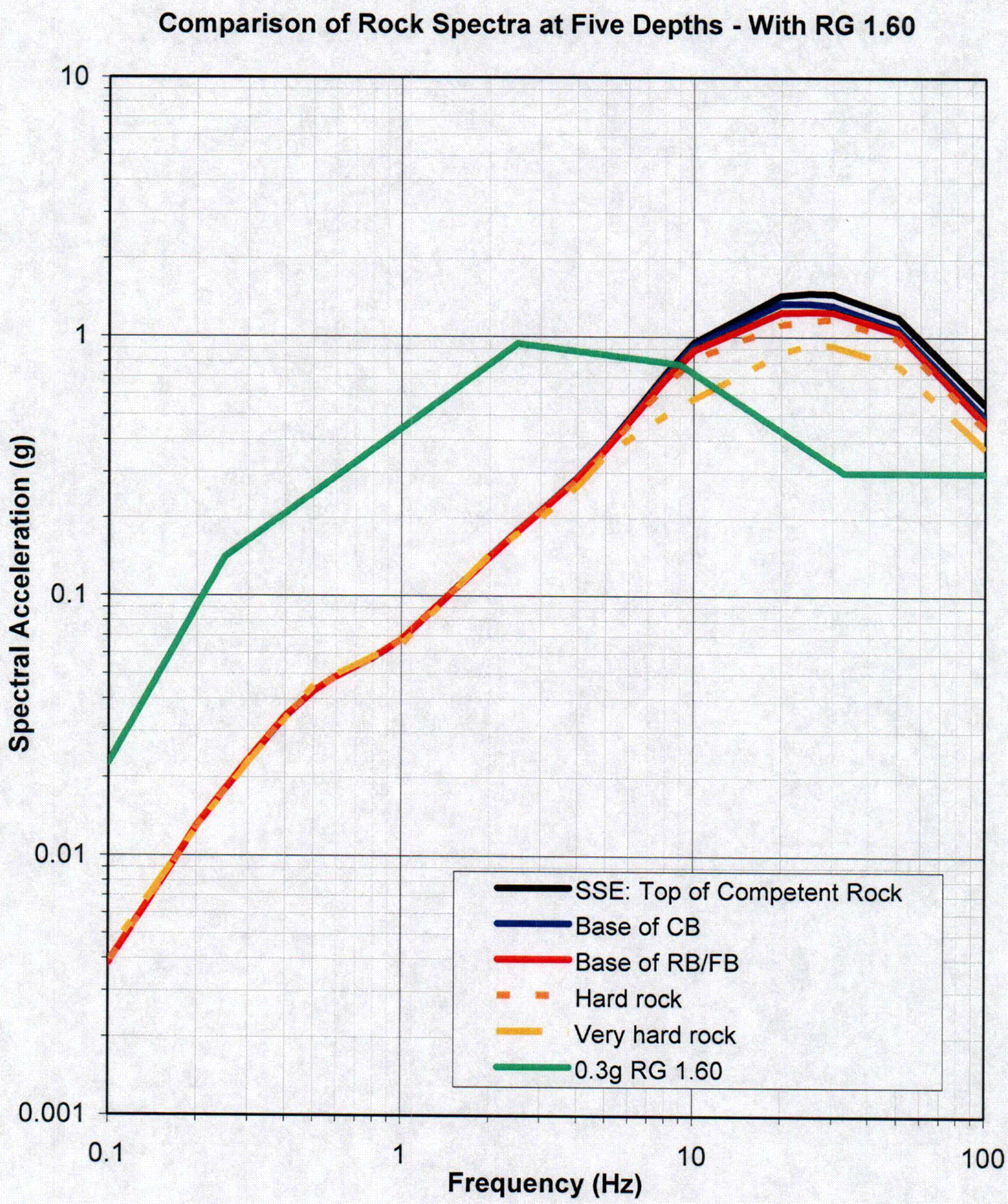


Figure 3.7-11 (1) - Comparison of North Anna ground motion spectra at the CB and RB/FB (and other) horizons with a RG 1.60 spectrum anchored to 0.3g PGA.

NRC RAI 3.7-12

DCD Section 3.7.1.1.3 provides a description of the North Anna ESP design ground motion (5% damping design ground response spectra at different foundation levels, comparisons of response spectra calculated from the modified ground motion time histories with the ESP ground response spectra, etc.). In order for the staff to reach a safety conclusion regarding the design adequacy (based on the ESP ground motion) of the RB/FB and CB, the applicant is requested to provide the following information in the DCD:

*(a) Which of the ESP ground response spectra (target spectra or spectra/1.10 or spectra*1.30) to be used for the seismic analysis and design?*
(b) The ESP response spectra for 2%, 3%, 4%, and 7% damping ratios.
(c) Definition of the "modified" ground motion time histories.
(d) Demonstrate that the response spectra calculated from the modified ground motion time histories envelop the design ESP ground response spectra for all damping ratios to be used in the analyses.
(e) Demonstrate that the modified ground motion time histories satisfy the PSD requirements (including how the target PSD was calculated).
(f) Basis for the statement in the second paragraph of Page 3.7-4, "the cross-correlations between the three individual components are all less than the 0.3 requirement." (The staff's position for the cross-correlations between the three individual components is 0.16. This staff's position had been applied for other design certification review, such as AP600, AP1000, etc.)

GE Response

(a) The horizontal and vertical target spectra (shown as solid light gray lines in DCD Figures 3.7-24, 3.7-26, 3.7- 28, 3.7-30, 3.7-32, and 3.7-34) are used for seismic analysis and design. Spectral matching of time histories associated with the target spectra was performed to satisfy criteria given in NUREG/CR-6728. These criteria provide a sound and more easily implemented method than the current version of the USNRC Standard Review Plan (NUREG-800) to generate time histories whose response spectra match design spectra. (See also the response to RAI 3.7-34.)

(b) See item (d) response below.

(c) The NUREG/CR-6728 criteria are devised to avoid any significant discrepancy between design and generated time history spectra at any frequency of interest. This requires a target spectrum digitized at 100 frequency points (equally spaced in log units) per frequency decade. Thus, for a frequency range of 0.1 Hz to 100 Hz, the target spectra are defined at 300 frequency points.

To quote and paraphrase further from NUREG/CR-6728 (Section 5.3), "the general objective is to generate an artificial or synthetic accelerogram that achieves approximately a mean-based fit to the target spectrum. That is, the average ratio of the spectral acceleration calculated from the accelerogram to the target, where the ratio is calculated frequency by frequency, is only slightly greater than 1. The aim is to achieve an accelerogram that does not have significant gaps in the Fourier amplitude spectrum but that is not biased high with respect to the target. An accelerogram that exceeds the target may overdrive a site soil column or structure where nonlinear response is of interest."

To achieve this aim NUREG/CR-6782 recommends that the computed 5% damped response spectrum of the accelerogram should not fall more than 10% below the target spectrum at any one frequency point (a factor of 1/1.1) and that the computed 5% damped response spectrum of the artificial ground motion should not exceed the target spectrum at any frequency by more than 30% (a factor of 1.3). In addition, to prevent large frequency ranges falling below the target, no more than nine adjacent spectral points may be allowed to fall below the target spectrum at any frequency.

These criteria have been used to develop the time histories associated with, and matching, the target spectra of DCD Section 3.7.1.1.3. To satisfy the 1/1.1 factor, 1.3 factor, and nine-adjacent-points criteria, a final scalar multiplication of the near-final time history was often necessary. This "scale factor" is shown above the top, left border of each target response spectrum plot. The factor is never less than 1.0 and never greater than 1.01. Multiplication of the penultimate time history by this scale factor results in the "modified" time history of the figures referenced in DCD Section 3.7.1.1.3.

To demonstrate graphically that these 1/1.1 and 1.3 factor criteria have been met, target spectra divided by 1.1 and multiplied by 1.3 are plotted on each of the figures so that it may be easily seen that the thin red line representing the response spectrum of the associated "modified" time history falls within these bounds for all frequencies.

(d) Spectral matching of time histories associated with the target spectra was performed to satisfy criteria given in NUREG/CR-6728, which only address 5% critically-damped response spectra. Ground response spectra for additional damping ratio values were not developed as part of the ESP. The requested demonstration, therefore, is not available.

(e) The ground motion time histories generated for the North Anna ground response spectra have not been tested against any PSD enveloping guidelines nor have target PSD spectra been developed for the high frequency target response spectrum. See the response to RAI 3.7-34.

(f) The cross-correlations have been calculated for the separate components of the time histories generated under the spectral matching criteria given in NUREG/CR-6728, and have been found to all be less than 0.16.

DCD Section 3.7.1.1.3 will be revised in the next update as noted in the attached markup.

NRC RAI 3.7-25

For the development of the RB/FB seismic model, the staff requests the applicant to specify in the DCD where the heavy crane (with trolley) is to be parked during plant operation. This information is needed to properly locate the mass and assess the effects of mass eccentricity in the seismic analysis. This information also needs to be identified as an interface item for the COL applicant.

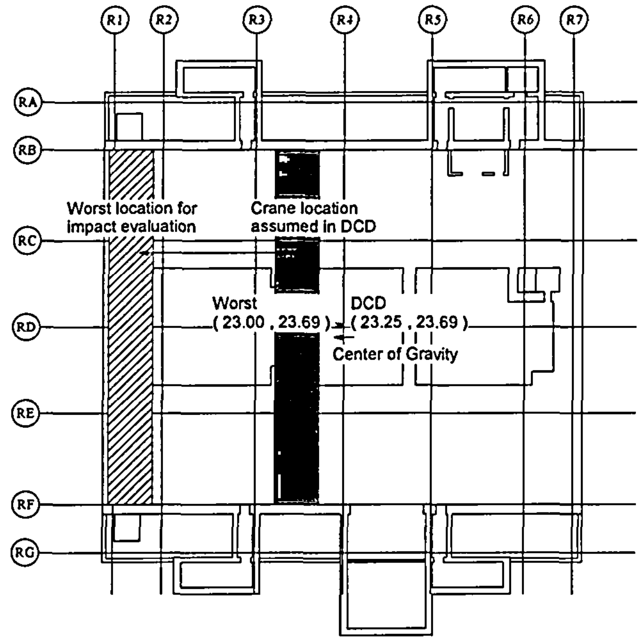
GE Response

For the development of the RB/FB seismic model, the heavy crane (with trolley) is assumed to be parked between col-rows R3 and R4 in the RB and between col-rows FB and FC in the FB.

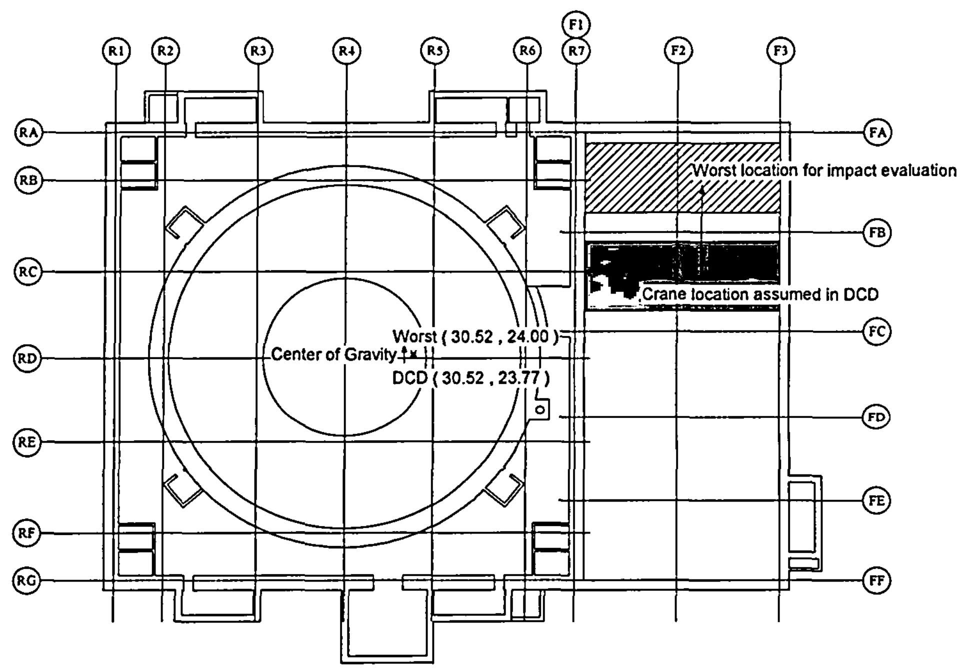
In order to assess the effects of crane location in the seismic analysis, the change of mass eccentricity was calculated varying the crane locations. A worst location is considered in the sensitivity analysis. Figure 3.7-25(1) shows the changes of the centers of gravity at the RB and FB crane floors. The centers of gravity moved only 25 cm maximum. Table 3.7-25 (1) shows comparison of eigenvalue analysis results for RBFB model in Fixed-base case. It is found that the difference of frequencies due to the crane location is negligibly small.

Hence, there is no need to identify crane location as an interface item for the COL applicant.

No DCD changes will be made in response to this RAI.



(a) EL 34.00



(b) EL 13.57

Figure 3.7-25 (1) - Crane Location for Seismic Analysis

Table 3.7-25 (1) - Comparison of Eigenvalue Analysis Results for RBFB Model in Fixed-base Case

MODE	FREQUENCY (Hz)		Difference
	DCD*1	Worst*2	
1	2.74	2.74	0.00%
2	3.81	3.81	0.00%
3	3.81	3.81	0.00%
4	3.94	3.94	0.03%
5	4.36	4.36	0.02%
6	5.21	5.21	0.00%
7	5.22	5.22	0.00%
8	5.98	5.98	0.00%
9	5.99	5.99	0.00%
10	6.09	6.09	-0.03%
11	6.75	6.75	0.00%
12	8.02	8.01	0.06%
13	8.58	8.58	0.04%
14	10.24	10.24	-0.02%
15	10.32	10.32	0.00%
16	10.52	10.52	0.00%
17	10.67	10.67	0.03%
18	11.23	11.23	0.00%
19	11.25	11.25	0.00%
20	11.89	11.89	0.00%
21	12.26	12.26	-0.01%
22	12.28	12.28	0.00%
23	12.56	12.56	-0.02%
24	12.82	12.82	-0.03%
25	13.38	13.37	0.05%
26	13.73	13.72	0.06%
27	14.86	14.86	0.01%
28	15.44	15.43	0.08%
29	15.88	15.89	-0.02%
30	16.25	16.25	0.00%

Note: Assumed crane locations are shown in Figure 3.7-25 (1).

*1: Crane location assumed in DCD.

*2: Worst location for impact evaluation.

NRC RAI 3.7-26

For seismic subsystem analysis, accurate in-structure response spectra are needed at the subsystem support points. The staff requests the applicant to describe in the DCD how it has considered the effects of out-of-plane vibration of floors and walls in the seismic structural models and the development of in-structure response spectra.

GE Response

As described in DCD Appendix 3A.7, a finite element model was used to obtain the vertical floor frequencies at major floor locations. The obtained frequencies were included in the stick model by a series of vertical single degree-of-freedom oscillators at the corresponding floor elevations. The in-structure response spectra were calculated using the oscillator responses.

Compared to the floors, the out-of-plane vibration frequencies of walls, which support subsystem designed using in-structure response spectra, are very high. Table 3.7-26 (1) shows the calculated out-of-plane fundamental frequencies for the typical walls in the RBFB. It is found from the calculations that the out-of-plane fundamental frequencies for the walls are higher than the highest frequency of interest at 50 Hz. Therefore, the effects of out-of-plane vibration of walls are not considered in the seismic structural models.

No DCD changes will be made in response to this RAI.

Table 3.7-26 (1) - Out-of-plane Fundamental Frequencies for Typical Walls

Building	Elevation (m)	Wall Thickness (m)	Frequency (Hz)
RBFB	EL -11.5 to EL-6.4	2.0	224
RBFB	EL-4.65 to EL -9.06	1.5	183
RBFB	EL27.0 to EL 34.0	1.0	68
RBFB	Above EL 34.0	1.0	53
CB	EL-2.0 to EL4.65	0.9	60

NRC RAI 3.7-29

The first sentence of DCD appendix 3A, Section 3A.1 states that this appendix presents SSI analysis performed for two site conditions, generic site and North Anna ESP site-specific, adopted to establish seismic design loads for the RB, FB, and CB of the ESBWR standard plant under SSE excitation. The definition of the SSE is not clear to the staff: is it both the 0.3g RG 1.60 ground motion response spectra and the North Anna ESP ground motion response spectra, or is it a combination (envelop) of these two spectra? The staff requests the applicant to clarify the definition of the SSE used for the ESBWR standard plant design in the DCD.

GE Response

Please refer to RAI 3.7-5 above.

<u>NRC RAI 3.7-34</u>

In the seismic analysis of the RB/FB and CB for the North Anna site conditions (ground motion and local geotechnical properties), the staff identified the following concerns:

a. *As indicated in DCD Figures 3.7-24 through 3.7-35, the North Anna ground motions at the base of the RB/FB are different from those at the CB base. The staff's concern is whether these ground motions are treated as design ground motions. If yes, it implies that the design ground motion is not uniquely defined (RG 1.60 ground motion and North Anna ground motions at the foundation base of the RB/FB and CB). The staff requests the applicant (1) clarify the definition of design ground motion in the DCD, and (2) define the design site parameters (Tier 1 information) in Tier 1 Table 5.1-1.*

b. *Do the ground motion time histories generated for the North Anna ground response spectra satisfy the response spectrum enveloping requirements for all damping ratios to be used for the seismic design? If yes, the staff requests that the comparison plots be provided in the DCD. If not, the staff requests the applicant to provide, in the DCD, technical basis for not satisfying these SRP guidelines.*

c. *Do the ground motion time histories generated for the North Anna ground response spectra satisfy the PSD enveloping guidelines? If yes, the staff requests that a detailed description showing how the target PSDs were developed, and showing the comparison, be provided in the DCD. If not, the staff requests the applicant provide, in the DCD, a technical basis for not satisfying these SRP guidelines.*

<u>GE Response</u>

a. Refer to the RAIs 3.7-5 and 3.7-8.

b. Refer to RAIs 3.7-12.

c. The ground motion time histories generated for the North Anna ground response spectra have not been tested against any PSD enveloping guidelines nor have target PSD spectra been developed for the high frequency target response spectrum. Instead, the methodology of NUREG/CR-6728 has been adopted. The reasons that NUREG/CR-6728 does not require spectrally matched time histories satisfy PSD enveloping guidelines are explained in Section 5.1 of the NUREG. To quote directly from that section:

   "The current version (NUREG-0800) of the USNRC Standard Review Plan (SRP) incorporates a specific requirement to consider the minimum Power Spectral Density (PSD) of ground motion records input to building, component, and soil models. Prior to this SRP, ground motion time histories used for such analyses

were evaluated based solely upon comparison of their response spectra with the design response spectrum for the site. The response spectrum enveloping criteria was based upon the engineering judgment that if the response spectral input at a given frequency exceeds the corresponding design spectral criteria, the computed system response at that frequency will exceed the response from the criteria input."

"However, it was recognized that a design response spectrum could be enveloped by the computed free-field response spectrum across a given frequency range, even though the PSD (or equivalently the Fourier amplitude spectrum) of the input ground motion could possess low levels (gaps) within the same frequency range. For this case, the computed system response may be under predicted if, for example, the soil-structure interaction (SSI) frequencies fall within those gaps. In addition, the development of large structural response computer codes currently used for system evaluations has made the ability to perform simple checks of computed response more difficult for the reviewer. Because of the ambiguities in the definition of a PSD as well as the effort involved in developing a minimum PSD requirement for an arbitrary target response spectrum, revised criteria are proposed herein that can be used to evaluate ground motion time histories to be used in the design or evaluation of critical facilities. These revised criteria eliminate the need for a separate PSD check but require that the target 5% damped response spectrum be closely matched both from above and below. The intent of the more stringent matching criteria is to ensure that the developed ground motion does not possess any significant gaps in frequency content. These revised criteria satisfy the general intent of the criteria contained in the SRP, which is currently defined in detail only for the spectral shape embodied by the R.G. 1.60 spectrum."

DCD Section 3.7.1.1.3 will be revised in the next update to include the above technical basis for not satisfying the SRP PSD enveloping guidelines as noted in the attached markup.

NRC RAI 3.7-52

DCD Section 3.7.3.13 does not provide any detail about the methods of analysis employed or the acceptance criteria used to determine structural design adequacy of buried conduits, tunnels, and auxiliary systems. In addition, the applicant did not provide the definition for the term "auxiliary systems." The staff requests the following additional information to complete its review:

(a) a description of the types of SSCs that are included under the category "auxiliary systems;"

(b) a description of the analysis method and acceptance criteria for buried conduits;

(c) a description of the analysis method and acceptance criteria for tunnels;

(d) a description of the analysis method and acceptance criteria for auxiliary systems.

GE Response

(a) See DCD Table 3.2-1 for identification of components in "auxiliary systems". See DCD Chapter 9 for identification and description of "auxiliary systems."

(b) There are no Seismic Class I buried conduits.

(c) There are no C-I tunnels in the ESBWR design. Tunnels in the ESBWR are NS but since some tunnels in the ESBWR carry liquid radwaste, the structural acceptance and materials criteria for tunnels are in accordance with RG 1.143 – Safety Class IIa. The method of seismic analysis is the same as building embedded walls, taking into account the requirements described in DCD Section 3.7.3.13.

(d) Same analysis methods and acceptance criteria is used for Auxiliary systems for underground portions of Category I structures, as shown in DCD Sections 3.8.4 and 3.8.5 for analysis and acceptance criteria details. Refer to DCD Chapter 9 for list of auxiliary systems.

DCD Sections 3.7.3.13, 3.7.3.14, and 3.7.3.15 will be clarified in the next update to remove reference to C-II as noted in the attached markup.

NRC RAI 3.7-55

To facilitate the staff's evaluation of the adequacy of computer codes used for design and analysis of the ESBWR Seismic Category I structures, the staff requests the applicant submit validation packages, translated into English, for the following computer codes listed in DCD Appendix 3C:

SSDP-2D
TEMCOM2
DAC3N

GE Response

The following validation packages are contained in Enclosure 2. These documents were prepared according to Shimizu QA program.

1) S/VTR-SD2, Validation Test Report for SSDP-2D, Rev. C
2) S/VTR-D3N, Validation Test Report for DAC3N, Rev. C
3) S/VTR-TEM, Validation Test Report for TEMCOM2, Rev. C

No DCD changes will be made in response to this RAI.

Table 5.1-1

Site Parameters

Parameter	Value
Exclusion Area Boundary (EAB):	An area whose boundary has a Chi/Q less than or equal to $1.0x10^{-3}$ sec/m^3
Extreme Wind: Basic Wind Speed:	 49.2 m/s (1) / 62.6 m/s (2)
Design Ambient Temperatures: 1% Exceedance Values Maximum: Minimum: 0% Exceedance Values (Historical Limit) Maximum: Minimum:	 37.8°C dry bulb/26.1°C wet bulb (coincident), 27.8°C wet bulb (non-coincident) –23.3°C 46.1°C dry bulb/26.7°C wet bulb (coincident), 29.4°C wet bulb (non-coincident) –40.0°C
Precipitation (for Roof Design): Maximum rainfall rate: Maximum snow load:	 49.3 cm/hr (3) 2.39 kPa
Tornado: Maximum tornado wind speed: Translational velocity Radius: Maximum pressure drop: Rate of pressure drop: Missile Spectra:	 147.5 m/s 31.3 m/s 45.7 m 16.6 kPa 11.7 kPa/s Spectrum I of SRP 3.5.1.4
Maximum Ground Water Level:	0.61 m below grade
Maximum Flood (or Tsunami) Level:	0.30 m below grade or less
Seismology (4): SSE Response Spectra:	 See Figures 5.1-1 and 5.1-2
Soil Properties: Minimum Static Bearing Capacity: Minimum Shear Wave Velocity: Liquefaction Potential:	 718 kPa 300 m/s (5) None at the site-specific SSE level

Notes:

(1) Value to be utilized for design of nonsafety-related structures only.

(2) Value to be utilized for design of safety-related structures only.

(3) Probable maximum precipitation (PMP) based on the maximum value for one hour over 2.6 km^2 with ratio of 5 minutes to 1 hour PMP of 0.32. Maximum short-term rate: 15.7 cm in 5 min.

(4) Safe Shutdown Earthquake (SSE) design ground response spectra are shown in Figures 5.1-1 and 5.1-2 in the horizontal and vertical directions respectively. They are defined as free-field outcrop spectra at the foundation level (bottom of the base slab).

(5) This is the minimum shear wave velocity at the foundation level.

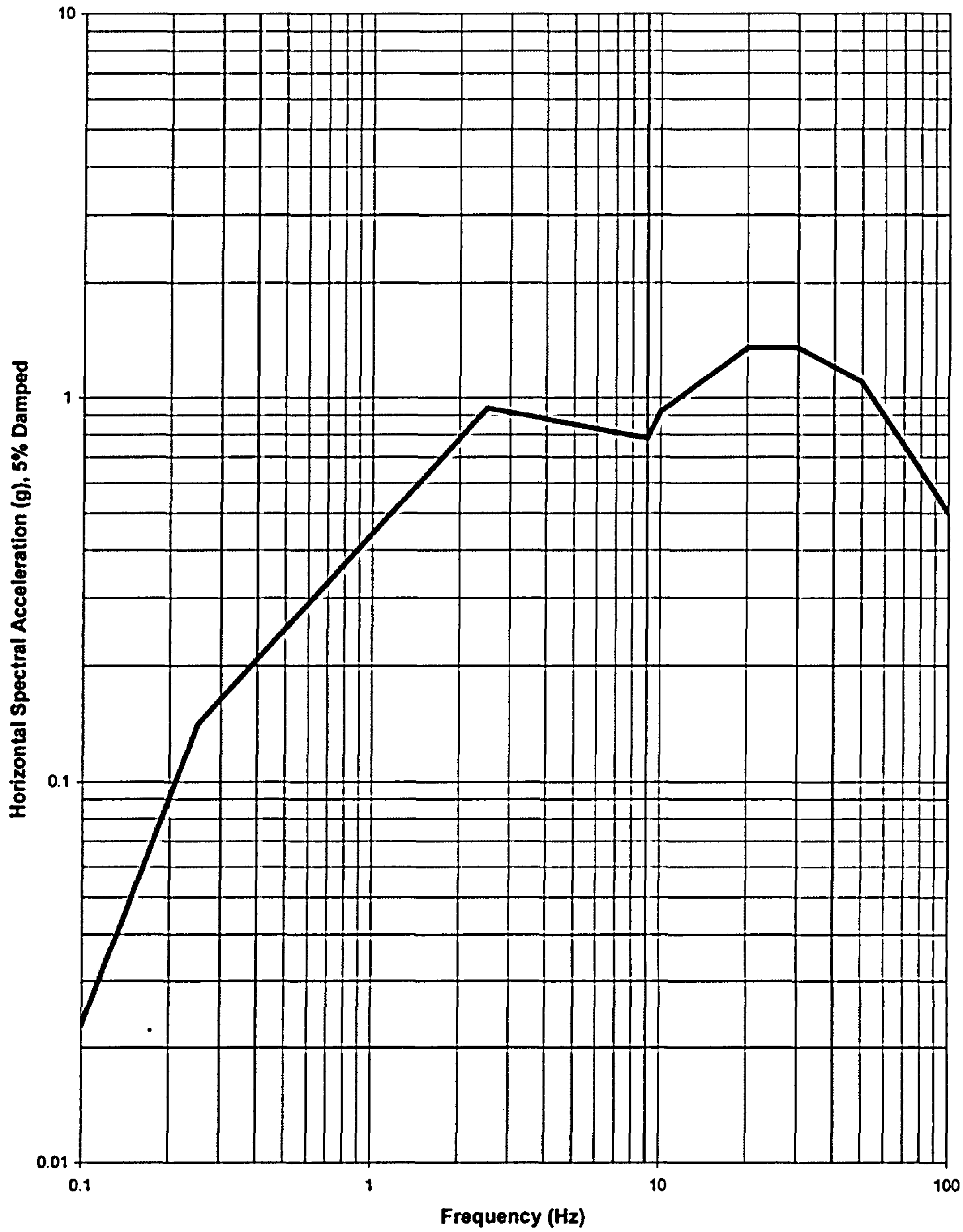


Figure 5.1-1. ESBWR Horizontal SSE Design Ground Spectra at Foundation Level

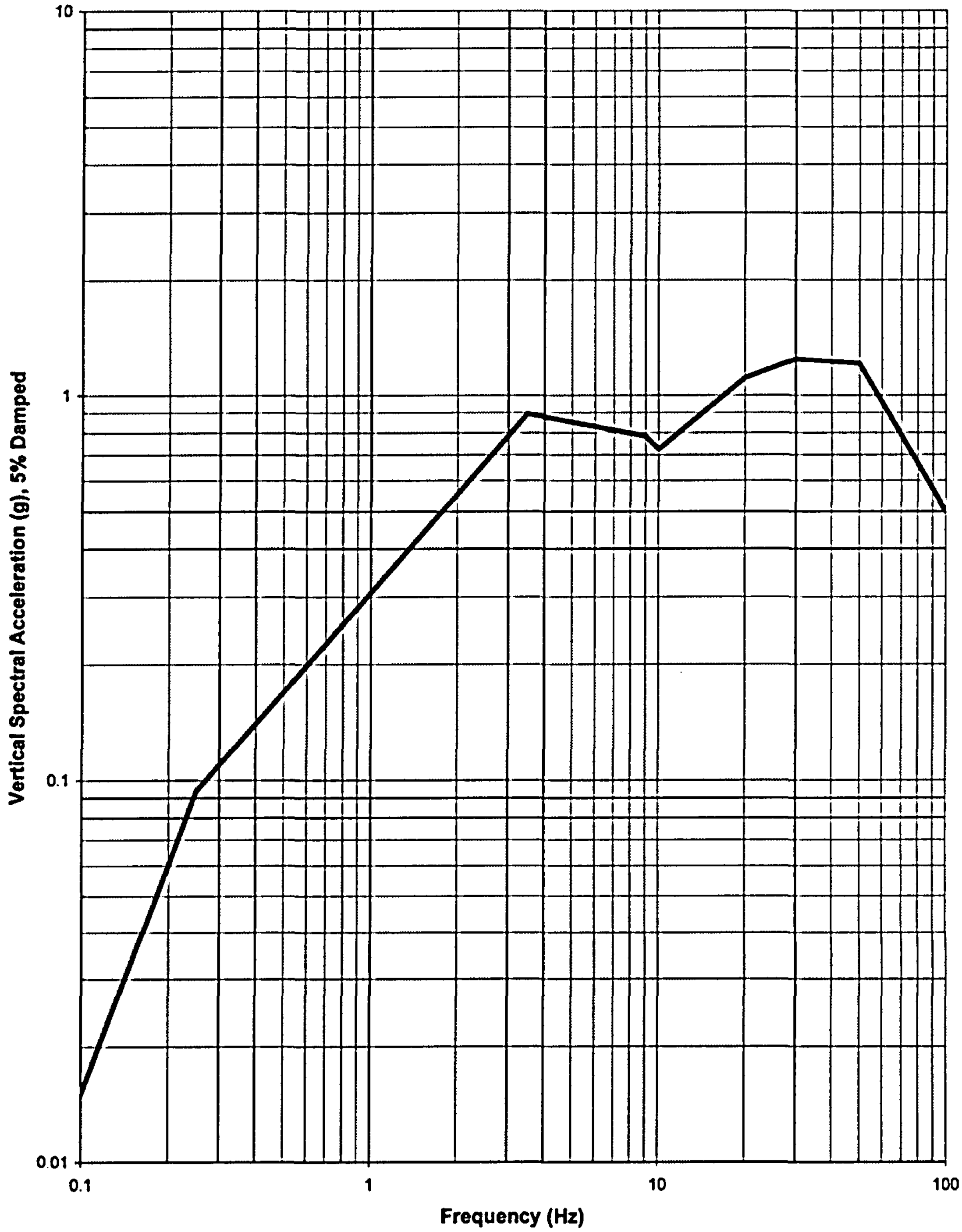


Figure 5.1-2. ESBWR Vertical SSE Design Ground Response Spectra at Foundation Level

Table 2.0-1

Envelope of ESBWR Reference Plant Site Design Parameters, Considerations and/or Limits

Subsection	Subject	Parameters/Considerations/Limits
2.4.13	Accidental Releases of Liquid Effluents in Ground and Surface Waters	ESBWR DCD: See DCD Tier-2 Chapter 15 "Liquid Containing Tank Failure" COL applicant to supply site-specific information in accordance with the SRP 2.4.13.
2.4.14	Technical Specifications and Emergency Operation Requirement	ESBWR see DCD Tier-2 Chapters 16 and 18. COL applicant to provide site-specific information in accordance with SRP 2.4.14.
2.5.1	Basic Geology and Seismic Information	ESBWR DCD: See subsections 2.5.2-2.5.5 of this table for ESBWR bounding parameters. COL applicant to provide site-specific information in accordance with SRP 2.5.1.
2.5.2	Vibratory Ground Motion:	ESBWR DCD: Safe Shutdown Earthquake (SSE) design ground response spectra are shown in Figures 2.5-1 and 2.5-2 in the horizontal and vertical directions, respectively. They are defined as free-field outcrop spectra at the foundation level (bottom of the base slab). COL applicant to provide site-specific information in accordance with SRP 2.5.2.
2.5.3	Surface Faulting	ESBWR design assumes no faulting at or near the ground surface. COL applicant to provide site-specific information in accordance with SRP 2.5.3.
2.5.4	Stability of Subsurface Materials and Foundations	ESBWR minimum static bearing capacity of the soil: At least 718 kPa (15000 lbf/sq ft). ESBWR minimum shear wave velocity: 300m/s (1000 fps). See Section 3.7.5.1 for further details. ESBWR design assumes no liquefaction potential under the foot-print of safety-related structures. Localized liquefaction potential under other structures will be addressed by the COL applicant. COL applicant to provide site-specific information in accordance with SRP 2.5.4.
2.5.5	Stability of Slopes	ESBWR design assumes stable slopes meeting a factor of safety of 1.5 for static (non-seismic) loading and 1.1 for dynamic (seismic) loading. COL applicant to provide site-specific information in accordance with SRP 2.5.5.

The applicable regulations and regulatory guides and basic acceptance criteria pertinent to the areas of this section of the Standard Review Plan are:

- General Design Criterion (GDC) 2, "Design Bases for Protection Against Natural Phenomena," in Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50. This criterion requires that the structures, systems, and components important to safety be designed to withstand the effects of earthquakes, tsunamis, and seiches without loss of capability to perform their safety functions.
- Section 100.23, "Geologic and Seismic Siting Factors." of 10 CFR Part 100. This section of Part 100 requires the applicant to determine the SSE and its uncertainty, the potential for surface tectonic and nontectonic deformations, the design bases for seismically induced floods and water waves, and other design conditions.
- Regulatory Guide 1.165, "Identification and Characterization of Seismic Sources and Determination of Safe Shutdown Earthquake Ground Motion." This guide describes acceptable methods to: (1) conduct geological, seismological, and geophysical investigations of the site and region around the site, (2) identify and characterize seismic sources, (3) perform PSHA, and (4) determine the SSE for the site (see SRP Subsection 2.5.2.6).
- Regulatory Guide 1.132, "Site Investigations for Foundations of Nuclear Power Plants." This guide describes programs of site investigations related to geotechnical aspects that would normally meet the needs for evaluating the safety of the site from the standpoint of the performance of foundations and earthworks under anticipated loading conditions, including earthquakes. It provides general guidance and recommendations for developing site-specific investigation programs as well as specific guidance for conducting subsurface investigations, such as borings and sampling.
- Regulatory Guide 4.7, "General Site Suitability Criteria for Nuclear Power Stations." This guide discusses the major site characteristics related to public health and safety that the NRC staff considers in determining the suitability of sites for nuclear power stations.

2.5.1.1 Regional Geology

COL applicant to provide site-specific information in accordance with SRP 2.5.1.

2.5.1.2 Site Geology

COL applicant to provide site-specific information in accordance with SRP 2.5.1.

2.5.2 Vibratory Ground Motion

ESBWR DCD: Safe Shutdown Earthquake (SSE) design ground response spectra are shown in Figures 2.5-1 and 2.5-2 in the horizontal and vertical directions, respectively. They are defined as free-field outcrop spectra at the foundation level (bottom of the base slab).

In accordance with SRP 2.5.2, in this subsection the COL applicant covers the seismological, geological, geophysical, and geotechnical investigations carried out to determine the safe shutdown earthquake (SSE) ground motion for the site. The SSE represents the design earthquake ground motion at the site and is the vibratory ground motion for which certain

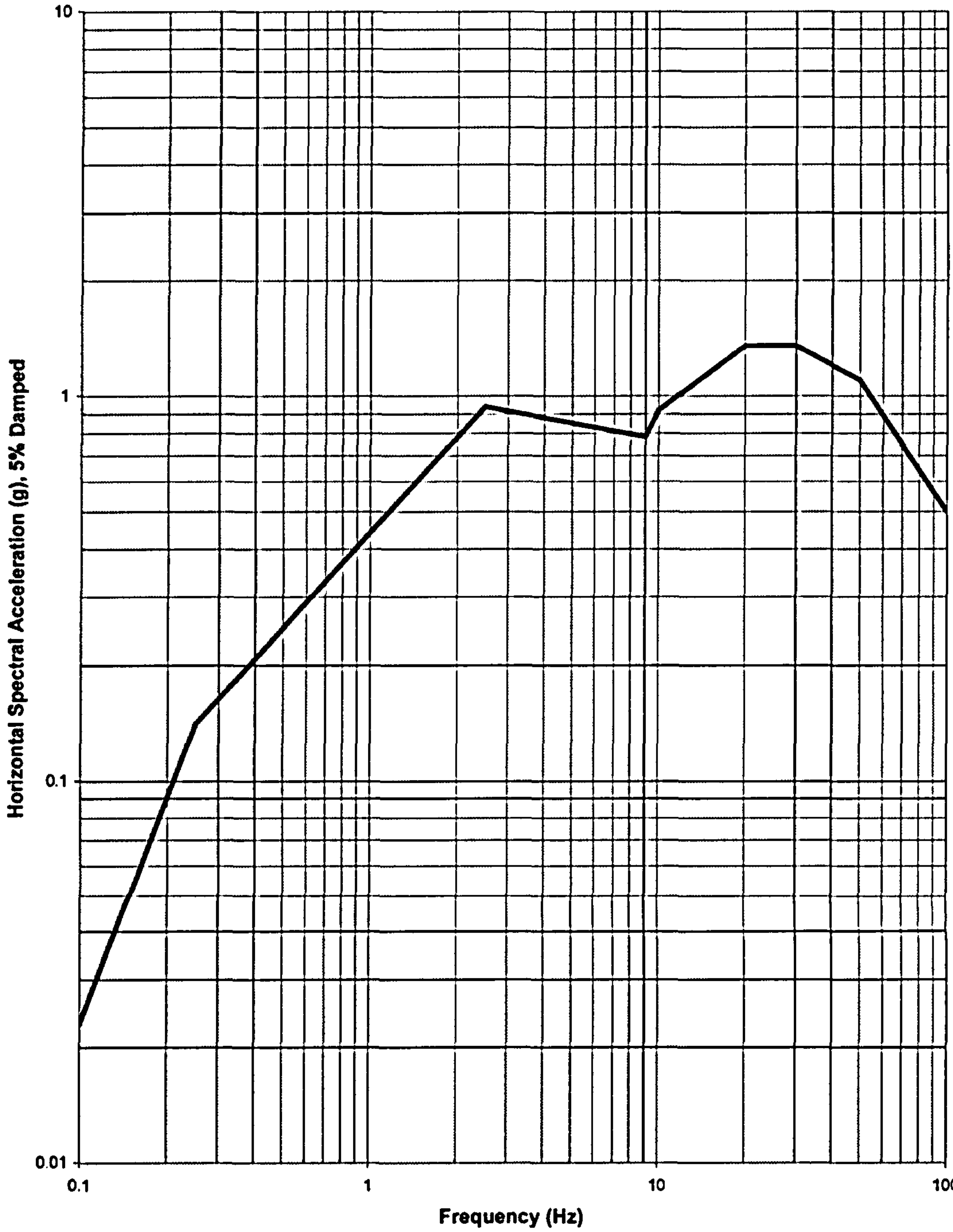


Figure 2.5-1. ESBWR Horizontal SSE Design Ground Spectra at Foundation Level

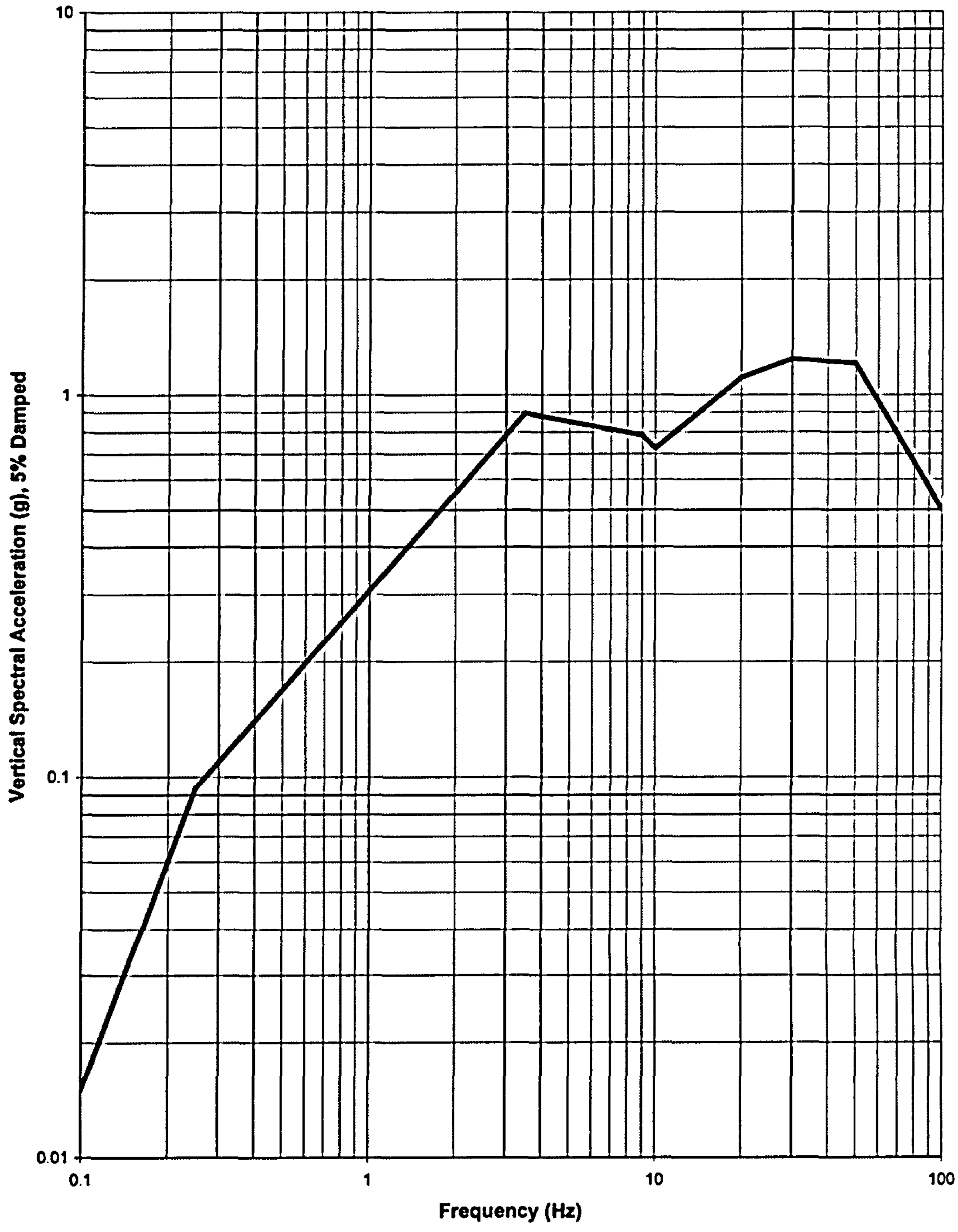


Figure 2.5-2. ESBWR Vertical SSE Design Ground Response Spectra at Foundation Level

$$9.0 < f \leq 16.0 \text{ Hz}$$

$$= \quad 89.88 cm^2/s^3(16.0/f)^{7.0}$$

$$f > 16.0 \text{ Hz}$$

The PSD function of vertical component of the design time history (SSE with 0.3g PGA) is computed and subsequently averaged and smoothed using SRP 3.7.1 criteria. Similarly, the target PSD is computed for 0.3g maximum acceleration. The PSD of the design time history is compared with the target and 80% of target PSD in Figure 3.7-23. As shown in this figure, PSD of the vertical time history envelops the target PSD with a wide margin. This comparison confirms the adequacy of energy content of the vertical time history.

The time histories of three spatial components are checked for statistical independency. The cross-correlation coefficient at zero time lag is 0.01351 between H1 and H2, 0.07037 between H1 and VT, and 0.07367 between H2 and VT. The cross-correlation coefficients are less than 0.16 as recommended in the reference of Regulatory Guide 1.92. Thus, H1, H2, and VT acceleration time histories are mutually statistically independent.

3.7.1.1.3 North Anna ESP Design Ground Motion

The ESBWR Reactor Building (RB) and Control Building (CB) foundations are embedded at depth of 20 m (66 ft) and 14.9 m (49 ft), respectively. The Fuel Building (FB) shares a common foundation mat with the RB. The corresponding foundation elevations at North Anna ESP site are EL. 205 ft for RB/FB and EL. 222 ft for CB. Since the low frequency parts of North Anna SSE ground spectra are enveloped by the 0.3g Regulatory Guide 1.60 generic site spectra with large margins, only the high frequency part needs to be explicitly taken into account. The high frequency SSE ground spectra and compatible time histories at elevations of CB and RB/FB foundation level are shown in Figures 3.7-24 to 3.7-35.

Data	CB Base	RB/FB Base
Horizontal H1 target spectrum	Figure 3.7-24	Figure 3.7-30
Horizontal H1 time histories	Figure 3.7-25	Figure 3.7-31
Horizontal H2 target spectrum	Figure 3.7-26	Figure 3.7-32
Horizontal H2 time histories	Figure 3.7-27	Figure 3.7-33
Vertical target spectrum	Figure 3.7-28	Figure 3.7-34
Vertical time histories	Figure 3.7-29	Figure 3.7-35

The spectrum figures are associated with 5% damping. The PGA values, corresponding to the spectral acceleration at 100 Hz of the target spectra, are 0.492g at the CB base and 0.469g at the RB/FB base in both horizontal and vertical directions. The time histories are generated under the spectral matching criteria given in NUREG/CR-6728 and the cross-correlations between the three individual components are all less than the 0.16 requirement. Since a more stringent matching criteria of NUREG/CR-6728 is used, a separate Power Spectral Density (PSD) check per SRP 3.7.1.II.1 is not required.

Differential endpoint or restraint deflections cause forces and moments to be induced into the system. The stress thus produced is a secondary stress. It is justifiable to place this stress, which results from restraint of free-end displacement of the system, in the secondary stress category because the stresses are self-limiting and, when the stresses exceed yield strength, minor distortions or deformations within the system satisfy the condition which caused the stress to occur.

3.7.3.13 Seismic Category I Buried Piping, Conduits and Tunnels

For Seismic Category C-I buried piping, conduits, tunnels, and auxiliary systems, the following items are considered in the analysis:

- Two types of ground shaking-induced loadings are considered for design:
  - Relative deformations imposed by seismic waves traveling through the surrounding soil or by differential deformations between the soil and anchor points.
  - Lateral earthquake pressures and ground-water effects acting on structures.
- The effects of static resistance of the surrounding soil on piping deformations or displacements, differential movements of piping anchors or equipment, and bent geometry and curvature changes, etc., are considered. When applicable, procedures using the principles of the theory of structures on elastic foundations can be used.
- When applicable, the effects caused by local soil settlements, soil arching, etc., are considered in the analysis.

3.7.3.14 Methods for Seismic Analysis of Seismic Category I Concrete Dams

For Seismic Category C-I concrete dams, if applicable to the site, the seismic analysis takes into consideration the dynamic nature of forces (due to both horizontal and vertical earthquake loadings), the behavior of the dam material under earthquake loadings, soil-structure interaction effects, and nonlinear stress-strain relations for the soil. FEM is the usual analytical tool used.

3.7.3.15 Methods for Seismic Analysis of Above-Ground Tanks

The seismic analysis of C-I above-ground tanks considers the following items:

- At least two horizontal modes of combined fluid-tank vibration and at least one vertical mode of fluid vibration are included in the analysis. The horizontal response analysis includes at least one impulsive mode in which the response of the tank shell and roof is coupled together with the portion of the fluid contents that move in unison with the shell, and the fundamental sloshing (convective) mode.
- The fundamental natural horizontal impulsive mode of vibration of the fluid-tank system is estimated giving due consideration to the flexibility of the supporting medium and to any uplifting tendencies for the tank. The rigid tank assumption is not made unless it can be justified. The horizontal impulsive-mode spectral acceleration, S_{a1}, is then determined using this frequency and damping value for the impulsive mode. This is the same as that for the tank shell material in accordance with NUREG/CR-1161. Alternatively, the maximum spectral acceleration corresponding to the relevant damping may be used.

- at frequencies between 2 and 10 Hz, the recorded response spectral accelerations of 5% damping exceed 1/3 of the corresponding SSE values or 0.2g, whichever is greater; or
- at frequency between 1 and 2 Hz, the recorded response spectral velocities of 5% damping exceed 1/3 of the corresponding SSE values or 152 mm/sec (6 in/sec), whichever is greater.

- CAV limit is exceeded if the CAV value calculated according to the procedures in Reference 3.7-12 is greater than 0.16 g-sec.

Following plant shutdown, post-shutdown inspections and tests are performed in accordance with Reference 3.7-10, as permitted by Regulatory Guide 1.167, to determine the physical condition of the plant and its readiness to resume operation. After plant is restarted (or prior to restart if the earthquake caused significant damage to the plant per Reference 3.7-10 definition), long-term evaluations are carried out for engineering assessments of plant structures and equipment using the actual event records to assure their long-term reliability in accordance with Reference 3.7-10 guidelines, as permitted by Regulatory Guide 1.167.

3.7.4.5 In-Service Surveillance

The seismic instrumentation operates during all modes of plant operation including periods of plant shutdown. The maintenance and repair procedures keep the maximum number of instruments in service during plant operation and shutdown. The walkdown inspection following a felt earthquake ensures the safety condition of the plant.

Each of the seismic instruments is demonstrated operable by the performance of the channel check, channel calibration, and channel functional test operations. The channel checks are performed every two weeks for the first three months of service after startup. After the initial three-month period and three consecutive successful checks, the channel checks are performed on a monthly basis. The channel calibration are performed during each refueling. The channel functional test is performed every 6 months.

3.7.5 COL Information

3.7.5.1 Seismic Design Parameters

To confirm the seismic design adequacy, COL Applicant referencing the ESBWR design shall demonstrate that the site-specific conditions meet the following site envelope parameters considered in the standardized design (Subsection 3.7.1).

(1) The site-specific free-field SSE ground response spectra of 5% damping defined as outcrop spectra at the foundation level (bottom of the base slab) is enveloped by the ESBWR design response spectra as shown in Figures 2.5-1 and 2.5-2 for horizontal and vertical direction, respectively.

(2) The site allowable foundation bearing capacities are no less than the values in Subsection 3G.1.5.5 for RB, Subsection 3G.2.5.5 for CB and Subsection 3G.3.5.5 for FB.

(3) The equivalent uniform shear wave velocity (V_{eq}) over the entire soil column is no less than 300 m/sec (1000 ft/sec) at seismic strain, which is a lower bound value after taking

Table 3.8-12

Temperatures During Operating Conditions (FB)

Region	Summer Operation	Winter Operation
Room	40°C	10°C
Spent fuel pool	60°C	40°C
Exterior	46.1°C	-40.0°C
Ground	15.5°C	15.5°C

Table 3.8-13

Key Dimensions of Foundations[YO554]

Building	Dimension	Notes
Reactor Building Fuel Building	Plan 70.0 m × 49.0 m	A common foundation of RB and FB
	Thickness = 4.0m	The thickness is increased to 5.1 m at the containment portion. (Refer to Subsection 3.8.1.1.1.)
	Top of foundation = 16 m below grade	
Control Building	Plan 30.3 m × 23.8 m	
	Thickness = 3.0 m	
	Top of foundation = 11.9 m below grade	

Table 3A.2-1

Standard ESBWR Building Dimensions

	RBFB Complex Dimensions (m)	CB Dimension (m)
0°–180° (NS) width	70.0	30.3
90°–270° (EW) width	49.0	23.8
Embedment depth	20	14.9

ENCLOSURE 3

MFN 06-189

Affidavit

General Electric Company

AFFIDAVIT

I, Louis M. Quintana, state as follows:

(1) I am Manager, Licensing, General Electric Company ("GE"), have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information sought to be withheld is contained in Enclosure 2 of GE letter MFN 06-189, David H. Hinds to USNRC, *Response to Portion of RAI Letter Number 20 Related to ESBWR Design Certification Application – Seismic Design – RAI Numbers 2.5-1, 3.7-5, 3.7-7, 3.7-8, 3.7-11, 3.7-12, 3.7-25, 3.7-26, 3.7-29, 3.7-34, 3.7-52, and 3.7-55,* dated June 29, 2006. The proprietary information in Enclosure 2, *Validation Packages - S/VTR-SD2, Validation Test Report for SSDP-2D, Rev. C, S/VTR-D3N, Validation Test Report for DAC3N, Rev. C, S/VTR-TEM, Validation Test Report for TEMCOM2, Rev. C – GE Proprietary Information,* is identified by the designation "GE Proprietary Information" on each page.

(3) In making this application for withholding of proprietary information of which it is the owner, GE relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC Sec. 552(b)(4), and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), and 2.790(a)(4) for "trade secrets" (Exemption 4). The material for which exemption from disclosure is here sought also qualify under the narrower definition of "trade secret", within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975F2d871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704F2d1280 (DC Cir. 1983).

(4) Some examples of categories of information which fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by General Electric's competitors without license from General Electric constitutes a competitive economic advantage over other companies;

b. Information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;

c. Information which reveals aspects of past, present, or future General Electric customer-funded development plans and programs, resulting in potential products to General Electric;

d. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs (4)a. and (4)b. above.

(5) To address 10 CFR 2.390 (b) (4), the information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GE, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GE, no public disclosure has been made, and it is not available in public sources. All disclosures to third parties including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in paragraphs (6) and (7) following.

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge. Access to such documents within GE is limited on a "need to know" basis.

(7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist or other equivalent authority, by the manager of the cognizant marketing function (or his delegate), and by the Legal Operation, for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GE are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.

(8) The information identified in paragraph (2), above, is classified as proprietary because it contains detailed ESBWR design information developed by GE and/or its partners over a period of several years at a cost of over one million dollars. This information, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GE's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of GE's comprehensive BWR safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation

process. In addition, the technology base includes the value derived from providing analyses done with NRC-approved methods.

The research, development, engineering, analytical and NRC review costs comprise a substantial investment of time and money by GE.

The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial.

GE's competitive advantage will be lost if its competitors are able to use the results of the GE experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GE would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GE of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing these very valuable analytical tools.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to the best of my knowledge, information, and belief.

Executed on this 29th day of June 2006.

Louis M. Quintana

Louis M. Quintana
General Electric Company