MITSUBISHI HEAVY INDUSTRIES, LTD.
16-5, KONAN 2-CHOME, MINATO-KU
TOKYO, JAPAN

November 11, 2010

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

Attention: Mr. Jeffery A. Ciocco

Docket No. 52-021
MHI Ref: UAP-HF-10308

Subject: MHI's Responses to US-APWR DCD RAI No. 643-4967 Revision 1 (SRP 03.07.01)

Reference: 1) "Request for Additional Information No. 643-4967 Revision 1, SRP Section: 03.07.01 - Seismic Design Parameters," dated 10/4/2010.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document entitled "Responses to Request for Additional Information No. 643-4967, Revision 1."

Enclosed are the responses to 5 RAIs contained within Reference 1. This transmittal completes the response to this RAI.

Please contact Dr. C. Keith Paulson, Senior Technical Manager, Mitsubishi Nuclear Energy Systems, Inc. if the NRC has questions concerning any aspect of this submittal. His contact information is provided below.

Sincerely,

Yoshiki Ogata,
General Manager- APWR Promoting Department
Mitsubishi Heavy Industries, LTD.

Enclosure:

1. Response to Request for Additional Information No. 643-4967, Revision 1

CC: J. A. Ciocco
C. K. Paulson

Contact Information
C. Keith Paulson, Senior Technical Manager
Mitsubishi Nuclear Energy Systems, Inc.
300 Oxford Drive, Suite 301
Monroeville, PA 15146
E-mail: ck_paulson@mnes-us.com
Telephone: (412) 373-6466

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Docket No. 52-021
MHI Ref: UAP-HF-10308

Enclosure 1

UAP-HF-10308
Docket No. 52-021

Response to Request for Additional Information No. 643-4967,
Revision 1

November, 2010

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

11/11/2010

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 643-4967 REVISION 1**
SRP SECTION:	***03.07.01 – Seismic Design Parameters***
APPLICATION SECTION:	**3.7.1**
DATE OF RAI ISSUE:	**10/04/10**

QUESTION NO. RAI 03.07.01-12:

In Section 3.7.1.3, "Supporting Media for Seismic Category I Structures," of Revision 1 of the DCD, a value of 15 ksf is specified as the required allowable static bearing capacity for seismic Category I building structure basemats. In RAI 1946 Question 3.7.1-7, the applicant was asked to provide the justification and technical basis for the value of 15 ksf as well as the justification of the minimum factor of safety of 2 that was proposed for the ultimate bearing capacity versus the allowable dynamic bearing capacity. The applicant responded to the RAI in a letter, MHI ref: UAP-HF-09187, dated April 23, 2009. The staff reviewed the applicant response and concluded that the response did not adequately address the issue and as a result, a follow-up RAI (RAI 3978, Question 3.7.1-9) was issued requesting that the applicant describe how the proposed value of 15 ksf is significant to the plant design and how the static and dynamic bearing pressures and corresponding soil capacities will be used in the plant design. The applicant responded to the follow-up RAI in a letter, MHI Ref: UAP-HF-10022, dated January 29, 2010. The staff evaluated the applicant response and considered the response to be inadequate because, the responses did not answer such questions as the difference between demand and capacity, the difference between static and dynamic values for bearing pressure, the technical basis for safety factors, and whether the 15 ksf value is intended to apply to the soil or to the building foundation.

In order to evaluate the Supporting Media for Seismic Category I Structures, per SRP Acceptance Criteria 3.7.1.II.3, the staff request MHI to provide response to the following specific questions:

1. Provide an analysis of the effect of the maximum groundwater level that is 1 ft below plant grade is considered on the analysis of static and dynamic bearing capacities of saturated soil and associated design safety factor.

2. Discuss what is the static bearing pressure demand value for the soil; the design value used for the static bearing pressure; the safety factor applied to the static bearing pressure; the justification for the minimum bearing pressure capacity; what is the dynamic bearing pressure demand value for the soil?

3. Provide a technical basis and justification for justification to support the minimum required dynamic bearing pressure capacity and state how it is governed, whether by the soil or the building foundation?

Reference: RAI Response 494-3978, UAP-HF-10022; dated January 29, 2010; ML100330617

ANSWER:

1. The effect of groundwater on ultimate bearing capacity is addressed by using the effective unit weight in calculating the effective stress and also in the weight term of the bearing capacity equation (use effective unit weight below groundwater level instead of total unit weight).

   Shear loading induces plastic volumetric strains in soils. In particular, loose and medium dense granular soils experience compactive volumetric strains under shear, while dense granular soils experience mainly dilative plastic volumetric strains. It has been verified experimentally that, under drained loading (static loads) the results in terms of effective stresses and the mechanical behavior of cohesionless soils was not affected by presence of water in soil (e.g. Finn et al 1978).

   In case of relatively fast cyclic loading (e.g. seismic loads) of saturated soils, the pore water does not have time to move out from (or into) the pores and the volume of the soil remains practically constant for a short time (undrained loading). In this situation, for loose to medium dense granular soil the tendency of volumetric compaction translates into an increase in the pore water pressure, with corresponding reduction of the effective stress and hence of the shear strength of the soil. Conversely, for dense soil the tendency of dilating under shear translates into a reduction of the pore water pressure (suction), with corresponding increase in effective stress and in shear strength. The granular soils considered in the DCD are very dense soils, with Vs > 1000ft/s (soil profile 270-500 in MUAP 10001), corresponding to Standard Penetration Test blowcounts N_{60} > 50...100 blows/ft (see e.g. Bowles 1996, eq. 20-17), corresponding in turn to very dense soil (e.g. Bowles 1996, Table 3-4). For this type of soils, presence of water leads to increase in shear strength during cyclic loading, and therefore ignoring this factor in analysis is on the conservative side.

   Based on the above considerations, the safety factors are not affected by presence of groundwater.

2. The static bearing pressure demand is the pressure that is applied to the soil for various static load combinations. As explained in the answer to Question 3.7.1-7, the DCD conservatively considers a maximum static bearing pressure demand of 15 ksf.

   The ultimate bearing capacity (q_u) is the maximum bearing pressure that can be applied to the soil without bearing capacity failure. It is estimated using the bearing capacity equation and depends on soil properties, foundation size and shape, and loading pattern. The recommended minimum factor of safety for static bearing pressure is FS_S = 2.5, based on upper ranges of published values (e.g. Bowles 1996, Table 4-9). The DCD will be revised to include this recommended minimum safety factor for static bearing capacity. It should be noted that it is the responsibility of the COL Applicant to justify use of factors of safety lower than recommended, based on the site-specific conditions (level of variations of water table elevation and soil conditions throughout the site) and the uncertainties related to measurements of site-specific properties of the soil.

   Due to the large footprint dimensions of the R/B complex and PS/B basemats, it is expected that maximum settlement conditions will govern the design of the US APWR standard plant foundations. The allowable bearing pressure, q_{all}, is the minimum of the following two quantities: (1) ultimate bearing pressure divided by the minimum factor of safety, or (2) bearing pressure corresponding to the maximum allowable settlement. The maximum bearing pressure demand must be less than or equal to the allowable bearing pressure. Table 2.0-1 of the Tier 2 DCD provides a maximum dynamic bearing pressure demand on the soil of 60 ksf, which is a toe pressure with the calculation methodology previously explained in the response to Open Item RGS1 2.5.4.

3. The minimum required dynamic bearing capacity is governed by the soil. The value provided in the DCD for dynamic bearing pressure demand is the maximum dynamic bearing pressure on the soil that is obtained from the results of seismic analyses. This value must be less than or equal to the minimum required dynamic pressure capacity (or minimum allowable dynamic bearing capacity as per DCD Tier 2 Table 2.0-1) which is governed by the ultimate capacity of the soil divided by the minimum factor of safety under dynamic loads (FS_D=2).

   The minimum dynamic factor of safety (FS_D) was established based on $FS_S=q_u/q_{al}$ and considering an accepted increase in soil strength by a factor of 1.33 under dynamic loads. Since q_u is estimated for soil resistance under static loading, $FS_D = FS_S / 1.33 = 1.88 \approx 2$.

REFERENCES

Bowles, J.E. (1996) *Foundation Analysis and Design*, Fifth Edition, McGraw-Hill.

Finn, W.D.L., Vaid, Y.P. and Bhatia, S.K. (1978) Constant volume cyclic simple shear testing, *Proceedings 2nd International Conference on Microzonation*, San Francisco, CA, pp.839-851.

Impact on DCD

See Attachment 1 for the mark-up of the DCD Tier 2, Section 3.7, changes to be incorporated.

- Change the 3rd sentence of the second paragraph in Subsection 3.7.1.3 to read as follows "The COL Applicant is to determine the allowable static and dynamic bearing capacities based on site conditions, and to evaluate the bearing loads to these capacities."

- Add at the end of the second paragraph in Subsection 3.7.1.3 the following sentence:

  "A minimum factor of safety of 2.5 is suggested for the ultimate bearing capacity versus the allowable static bearing capacity; however, a different value may be justified based on site-specific geotechnical conditions."

- Change COL3.7(7) in Subsection 3.7.5 to read as follows "The COL Applicant is to determine the allowable static and dynamic bearing capacities based on site conditions, and to evaluate the bearing loads to these capacities."

See Attachment 2 for the mark-up of the DCD Tier 2, Section 1.8, changes to be incorporated.

- Change COL3.7(7) in Table 1.8-2 (sheet 7 of 44) of Subsection 1.8 to read as follows "The COL Applicant is to determine the allowable static and dynamic bearing capacities based on site conditions, and to evaluate the bearing loads to these capacities."

Impact on COLA

Table 3.8-202 in both the Comanche Peak R-COLA and the North Anna S-COLA provides applied static bearing pressures and allowable static bearing capacities. The safety factor used to compute allowable static bearing capacity at Comanche Peak Units 3 and 4 and North Anna Unit 3 is greater (more conservative) than the value adopted in the DCD in this response. The text and left-margin notation of the R-COLA and S-COLA will be adjusted to align with the revised text discussed in "Impact on DCD" above.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

11/11/2010

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 643-4967 REVISION 1**
SRP SECTION:	**03.07.01 – Seismic Design Parameters**
APPLICATION SECTION:	**3.7.1**
DATE OF RAI ISSUE:	**10/04/10**

QUESTION NO. 03.07.01-13:

This request for additional information (RAI) is necessary for the staff to determine if the application meets the requirements of 10 CFR Part 50, Appendix A, General Design Criteria 2; 10 CFR Part 50 Appendix S; and 10 CFR Part 100; as well as the guidance in NUREG-0800, "Standard Review Plan for the Review of Safety Analysis for Nuclear Power Plants," Chapter 3.7.1, "Seismic Design Parameters."

Section 4.2.1, "Selection of Profiles," of MHI's Topical Report, MUAP-10001, Revision 1, "Seismic Design Bases of the US-APWR Standard Plant," states that the profiles adopted for the development of CSDRS consistent strain compatible properties include 270 m/s, 560 m/s, 900 m/s, and 2,032 m/s and that three depths of soil/rock profiles above the hard or soft rock foundations are considered: 100 ft, 200 ft, and 500 ft. The report also stated that due to the stiffness of the 2,032 m/s firm rock profile, only a 100 ft deep profile reflects realistic site conditions and represents a residual soil over weathered rock and underlain by hard rock. However, in Tables 5.2-1, "Final Profile Categories," and 5.2-2, "Magnitudes, Distances, and Median Peak Accelerations," of the report, the applicant did not present all the profile cases considered. Thus, the staff requests that the applicant provide a technical basis for not analyzing all cases.

Reference: USAPWR Seismic Design Report MUAP-10001, rev 1; dated May 13, 2010; ML101400073

ANSWER:

A similar question and information request on the soil profiles used for the standard design and analysis was asked by the NRC Staff in RAI 625-4924 Rev. 0, Question 03.07.02-23. See MHI response for RAI 625-4924, Question 03.07.02-23.

Impact on DCD

There is no impact on the DCD. For impact on report TR MUAP-10001, see MHI response for RAI 625-4924, Question 03.07.02-23.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

11/11/2010

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 643-4967 REVISION 1**
SRP SECTION:	**03.07.01 – Seismic Design Parameters**
APPLICATION SECTION:	**3.7.1**
DATE OF RAI ISSUE:	**10/04/10**

QUESTION NO. 03.07.01-14:

This request for additional information (RAI) is necessary for the staff to determine if the application meets the requirements of 10 CFR Part 50, Appendix A, General Design Criteria 2; 10 CFR Part 50 Appendix S; and 10 CFR Part 100; as well as the guidance in NUREG-0800, "Standard Review Plan for the Review of Safety Analysis for Nuclear Power Plants," Chapter 3.7.1, "Seismic Design Parameters."

In Section 4.2.1, "Selection of Profiles," of MHI's Topical Report, MUAP-10001, Revision 1, "Seismic Design Bases of the US-APWR Standard Plant," states that for compressional-waves, a water table depth at the surface (foundation level) of each profile was assumed and that the US-APWR DCD specifies a water table depth of 1 foot below the foundation which, for the development of vertical motions, is equivalent to the surface.

In review of the US-APWR DCD, Revision 2, Tier 1, Table 2.1-1, "Key Site Parameters," and Tier 2, Table, 5.2-2, "Key Site Parameters," both listed the maximum groundwater level as being 1 foot below plant grade and not below the foundation as stated in the report. The staff considers the difference between the 'foundation level' and the '1 ft below plant grade' to be significant and most importantly, that the ground water level can greatly affect the analysis results. Thus, the staff requests that the applicant provide a technical basis for assuming a water table depth at the 'foundation level' of each profile compared with '1 foot below plant grade' as prescribed in Revision 2 of the US-APWR DCD.

Reference: USAPWR Seismic Design Report MUAP-10001, rev 1; dated May 13, 2010; ML101400073

ANSWER:

A similar question and information request on the location of the groundwater level used for the standard design and analysis was asked by the NRC Staff in RAI 625-4924 Rev. 0, Question 03.07.02-21. See MHI's detailed response to RAI 625-4924 Rev. 0, Question 03.07.02-21 for detailed resolution of this issue.

Impact on DCD

There is no impact on the DCD. For impact on report TR MUAP-10001, see MHI response for RAI 625-4924, Question 03.07.02-21.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

11/11/2010

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 643-4967 REVISION 1**
SRP SECTION:	**03.07.01 – Seismic Design Parameters**
APPLICATION SECTION:	**3.7.1**
DATE OF RAI ISSUE:	**10/04/10**

QUESTION NO. 03.07.01-15:

This request for additional information (RAI) is necessary for the staff to determine if the application meets the requirements of 10 CFR Part 50, Appendix A, General Design Criteria 2; 10 CFR Part 50 Appendix S; and 10 CFR Part 100; as well as the guidance in NUREG-0800, "Standard Review Plan for the Review of Safety Analysis for Nuclear Power Plants," Chapter 3.7.1, "Seismic Design Parameters."

In Section 1.0, "Introduction," of MHI's Topical Report, MUAP-10001, Revision 1, "Seismic Design Bases of the US-APWR Standard Plant," it states that the seismic design of the standard plant structures is based on a set of SSI analyses performed using the computer program ACS SASSI, which provides a representation of the dynamic properties of the building, and captures the SSI effects related to the flexibility of the basemat foundation.

In the review of the SSI model referenced in the report, the staff identified that Version 2.2 of the ACS SASSI is used in the SSI analyses for the US-APWR standard plant. Since irregularities were observed in other SSI analyses using Version 2.2 of the ACS SASSI computer code in an Event Notification Report, Number 45343, dated September 14, 2009, the staff requests the applicant to provide technical bases for using Version 2.2 of the ACS SASSI program to perform the SSI analyses for the US-APWR standard plant and to validate the analysis results.

Reference: USAPWR Seismic Design Report MUAP-10001, rev 1; dated May 13, 2010; ML101400073

ANSWER:

The calculations documenting the SSI analyses considered in TR MUAP-10001 Rev 1 were performed with ACS SASSI Version 2.3.0. Therefore Reference 2 in Section 6.0 shall be corrected as follows in the next revision of TR MUAP-10001.

ACS SASSI Version 2.3.0: "An Advanced Computational Software for 3D Dynamic Analyses Including Soil Structure Interaction", Ghiocel Predictive Technologies, Inc., June 15, 2009.

Impact on DCD

There is no impact on the DCD. TR MUAP-10001 Rev. 1 will be corrected as described above.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

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US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 643-4967 REVISION 1**
SRP SECTION:	**03.07.01 – Seismic Design Parameters**
APPLICATION SECTION:	**3.7.1**
DATE OF RAI ISSUE:	**10/04/10**

QUESTION NO. 03.07.0-16:

This request for additional information (RAI) is necessary for the staff to determine if the application meets the requirements of 10 CFR Part 50, Appendix A, General Design Criteria 2; 10 CFR Part 50 Appendix S; and 10 CFR Part 100; as well as the guidance in NUREG-0800, "Standard Review Plan for the Review of Safety Analysis for Nuclear Power Plants," Chapter 3.7.1, "Seismic Design Parameters."

Based on the review of Section 4.2, "Development of Soil Profiles and strain Compatible Properties," of MHI's Topical Report, MUAP-10001, Revision 1, "Seismic Design Bases of the US-APWR Standard Plant," staff understands that the selected soil profiles also represent hard rock site conditions that are expected in Central and Eastern United States (CEUS). Hard rock implies rather large spectral content in the high frequency range of the ground motion. Recent industry studies have shown that hardrock high frequency (HRHF) ground motions frequently result in large in-structure response spectra or structural responses.

However, the information presented in Chapter 5 of the report does not show the high frequency response typically expected at the hard rock sites in the central and eastern United States (CEUS) regions. This is indicative of the deficiencies in SSI and structural models that are not sufficiently refined to capture the high frequency input (the range of high frequency to be transmitted should cover a model refinement frequency of at least equal to 50 Hz.), or low spectral content in the high frequency range of the ground motion, or both.

The staff requests that the applicant provide a technical bases and justification that shows that the SSCs for the standard design certification are adequately designed for hard rock site conditions that are expected in Central and Eastern United States (CEUS). Otherwise, state in the US-APWR DCD that the exception is taken to hard rock site conditions expected in Central and Eastern United States (CEUS).

Reference: USAPWR Seismic Design Report MUAP-10001, rev 1; dated May 13, 2010; ML101400073

ANSWER:

It is recognized that for some of the hard rock sites in Central and Eastern United States (CEUS), the US-APWR CSDRS does not envelope the response spectra characteristic in the high frequency range. Nevertheless, there are rock sites in CEUS, such as the site of the Comanche Peak R-COLA where the CSDRS envelopes the site-specific design ground motion response spectra and where the standard seismic design envelopes all of the site-specific seismic demands.

The discussion of the CSDRS in Subsection 3.7.1 and COL item 3.7(22) of the US-APWR DCD state:

> "The modified RG 1.60 (Reference 3.7-6) spectra used for the CSDRS are expected to envelope many sites in the central and eastern United States in order to maximize the applicability of the US-APWR standard plant design; however, it is anticipated that there are some site-specific instances, particularly on hard rock sites in high seismic areas, where high-frequency exceedances of the CSDRS may occur. In these cases, the COL Applicant is required to perform site-specific seismic analyses, including a soil-structure interaction (SSI) analysis which considers seismic wave transmission incoherence and analysis of the cumulative absolute velocity (CAV) of the seismic input motion, in order to determine if high-frequency exceedances of the CSDRS could be transmitted to SSCs in the plant superstructure with potentially damaging effects."

For these sites, the results of the mandatory site-specific SSI analyses of Category I buildings will provide site-specific SSE design loads and ISRS that will be compared to the SSE loads and ISRS used for the standard design in order to determine the effect of the high frequency exceedances on the design.

The finite element (FE) structural model used for the SSI analyses of PS/B is refined enough to capture responses of modes with frequencies above 50 Hz. The lumped mass stick models used for the SSI analyses of R/B complex were enhanced in order to capture local out-of-plane high frequency vibrations. The acceleration response spectra results obtained from the SSI analyses of R/B complex were grouped in a manner to provide ISRS that will envelope the high frequency responses not captured by the R/B complex lumped mass stick model. A dynamic FE model of the R/B complex structures is currently under development. As described in the response to question 03.07.02-11 of RAI 625-4924, the validation of the FE model will be performed to demonstrate its ability to capture responses of modes up to 50 Hz. The results obtained from the site-independent SSI analyses of the FE model of R/B complex will be used to verify and enhance the ISRS obtained from the site independent analyses of the lumped-mass stick model.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

This completes MHI's responses to the NRC's questions.

The damping values for systems that include two or more substructures, such as a concrete and steel composite structure, can be obtained using the strain energy method. The strain energy dependent modal damping values are computed based on Reference 3.7-18, which is the same as the stiffness weighted composite modal damping method, and acceptable to SRP 3.7.2 (Reference 3.7-16).

The stiffness weighted modal damping ratio h_j of the j^{th} mode is obtained from the following equation:

$$h_j = \frac{\vec{\phi}_j^T [\overline{K}] \vec{\phi}_j}{\vec{\phi}_j^T [K] \vec{\phi}_j}$$

where

$[K]$ = the stiffness matrix of the combined soil-structure system

$\vec{\phi}_j$ = the j^{th} normalized mode shape vector

$[\overline{K}] = \sum [k_i] \cdot \xi_i$ = the modified stiffness matrix constructed from the products of the element stiffness matrices $[k_i]$ and the applicable damping ratio ξ_i

Formulation of damping values for the seismic analysis models which incorporate the combined soil-structure damping is discussed in Subsection 3.7.2.1. Damping values associated with site-specific SSI analyses are addressed in Subsection 3.7.2.4.1.

3.7.1.3 Supporting Media for Seismic Category I Structures

A range of soil parameters of the basemat supporting media are considered in the seismic design of seismic category I building structures for the US-APWR standard plant. The overall basemat dimensions, basemat embedment depths, and maximum height of the US-APWR R/B, PCCV, and containment internal structure on their common basemat are given in Table 3.7.1-3 and as updated by the COL Applicant to include site-specific seismic category I structures.

The required allowable static bearing capacity for seismic category I building structure basemats, including the R/B-PCCV-containment internal structure on their common basemat, is 15 ksf. The dynamic bearing loads for seismic category I structure basemats are dependent upon the magnitude of the seismic loads that can be obtained from a site-specific seismic analysis that considers FIRS. The COL Applicant is to determine the allowable static and dynamic bearing capacity~~y~~ies based on site conditions, and to evaluate the bearing loads to thi~~s~~ese capacity~~y~~ies. A minimum factor of safety of 2 is suggested for the ultimate bearing capacity versus the allowable dynamic bearing capacity; however, a different value may be justified based on site-specific geotechnical conditions. A minimum factor of safety of 2.5 is suggested for the ultimate bearing capacity versus the allowable static bearing capacity; however, a different value may be justified based on site-specific geotechnical conditions.

The site-independent seismic design of seismic category I and seismic category II SSCs uses lumped parameter representation to model the interaction of seismic category I structures with the supporting media. The lumped parameter model considers a rigid

COL3.7(5) *The COL Applicant is to assure that the horizontal FIRS defining the site-specific SSE ground motion at the bottom of seismic category I or II basemats envelope the minimum response spectra required by 10 CFR 50, Appendix S, and the site-specific response spectra obtained from the response analysis.*

COL3.7(6) *The COL Applicant is to develop site-specific GMRS and FIRS by an analysis methodology, which accounts for the upward propagation of the GMRS. The FIRS are compared to the CSDRS to assure that the US-APWR standard plant seismic design is valid for a particular site. If the FIRS are not enveloped by the CSDRS, the US-APWR standard plant seismic design is modified as part of the COLA in order to validate the US-APWR for installation at that site.*

COL3.7(7) *The COL Applicant is to determine the allowable static and dynamic bearing capacityies based on site conditions, and to evaluate the bearing loads to thisese capacityies.*

COL3.7(8) *The soil properties may be considered strain-independent for subgrade materials with initial shear wave velocities of 3,500 ft/s or higher, to be confirmed by the COL Applicant as part of the site-specific subsurface material investigations discussed in Section 2.5.4. However, the COL Applicant must institute dynamic testing to evaluate the strain-dependent variation of the material dynamic properties for site materials with initial shear wave velocities below 3,500 ft/s.*

COL3.7(9) *The COL Applicant is to assure that the design or location of any site-specific seismic category I SSCs, for example pipe tunnels or duct banks, will not expose those SSCs to possible impact due to the failure or collapse of non-seismic category I structures, or with any other SSCs that could potentially impact, such as heavy haul route loads, transmission towers, non safety-related storage tanks, etc.*

COL3.7(10) *It is the responsibility of the COL Applicant to further address structure-to-structure interaction if the specific site conditions can be important for the seismic response of particular US-APWR seismic category I structures, or may result in exceedance of assumed pressure distributions used for the US-APWR standard plant design.*

COL3.7(11) *Deleted*

COL3.7(12) *It is the responsibility of the COL Applicant to design seismic category I below- or above-ground liquid-retaining metal tanks such that they are enclosed by a tornado missile protecting concrete vault or wall, in order to confine the emergency gas turbine fuel supply.*

Table 1.8-2 Compilation of All Combined License Applicant Items for Chapters 1-19 (sheet 7 of 44)

COL ITEM NO.	COL ITEM
COL 3.7(6)	*The COL Applicant is to develop site-specific GMRS and FIRS by an analysis methodology, which accounts for the upward propagation of the GMRS. The FIRS are compared to the CSDRS to assure that the US-APWR standard plant seismic design is valid for a particular site. If the FIRS are not enveloped by the CSDRS, the US-APWR standard plant seismic design is modified as part of the COLA in order to validate the US-APWR for installation at that site.*
COL 3.7(7)	*The COL Applicant is to determine the allowable static and dynamic bearing capacityies based on site conditions, and to evaluate the bearing loads to thisese capacityies.*
COL 3.7(8)	*The soil properties may be considered strain-independent for subgrade materials with initial shear wave velocities of 3,500 ft/s or higher, to be confirmed by the COL Applicant as part of the site-specific subsurface material investigations discussed in Section 2.5.4. However, the COL Applicant must institute dynamic testing to evaluate the strain-dependent variation of the material dynamic properties for site materials with initial shear wave velocities below 3,500 ft/s.*
COL 3.7(9)	*The COL Applicant is to assure that the design or location of any site-specific seismic category I SSCs, for example pipe tunnels or duct banks, will not expose those SSCs to possible impact due to the failure or collapse of non-seismic category I structures, or with any other SSCs that could potentially impact, such as heavy haul route loads, transmission towers, non safety-related storage tanks, etc.*
COL 3.7(10)	*It is the responsibility of the COL Applicant to further address structure-to-structure interaction if the specific site conditions can be important for the seismic response of particular US-APWR seismic category I structures, or may result in exceedance of assumed pressure distributions used for the US-APWR standard plant design.*
COL 3.7(11)	*Deleted*
COL 3.7(12)	*It is the responsibility of the COL Applicant to design seismic category I below- or above-ground liquid-retaining metal tanks such that they are enclosed by a tornado missile protecting concrete vault or wall, in order to confine the emergency gas turbine fuel supply.*