HITACHI

GE Hitachi Nuclear Energy

Richard E. Kingston
Vice President, ESBWR Licensing

P.O. Box 780
3901 Castle Hayne Road, M/C A-65
Wilmington, NC 28402 USA

T 910.819.6192
F 910.362.6192
rick.kingston@ge.com

MFN 09-747 Docket No. 52-010

December 1, 2009

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

Subject: **Response to Portion of NRC RAI Letter No. 384 Related to ESBWR Design Certification Application – DCD Tier 2 Section 3.8 – Seismic Category I Structures; RAI Number 3.8-129**

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) response to a portion of the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) letter number 384 sent by NRC letter dated October 27, 2009 (Reference 1). RAI Number 3.8-129 is addressed in Enclosure 1. Enclosure 2 contains the DCD changes to Tier 2 as a result of GEH's response to this RAI. Verified DCD changes associated with these RAI responses are identified in the enclosed DCD markups by enclosing the text within a black box.

If you have any questions or require additional information, please contact me.

Sincerely,

Richard E. Kingston

Richard E. Kingston
Vice President, ESBWR Licensing

Reference:

1. MFN 09-685 Letter from U.S. Nuclear Regulatory Commission to J. G. Head, GEH, *Request For Additional Information Letter No. 384 Related to ESBWR Design Certification* dated October 27, 2009

Enclosures:

1. Response to Portion of NRC RAI Letter No. 384 Related to ESBWR Design Certification Application - DCD Tier 2 Section 3.8 – Seismic Category I Structures; RAI Number 3.8-129
2. Response to Portion of NRC RAI Letter No. 384 Related to ESBWR Design Certification Application - DCD Markups for RAI Number 3.8-129

cc:	AE Cubbage	USNRC (with enclosures)
	JG Head	GEH/Wilmington (with enclosures)
	DH Hinds	GEH/Wilmington (with enclosures)
	HA Upton	GEH/San Jose (with enclosures)
	eDRF Section	0000-0109-3727 (RAI 3.8-129)

ENCLOSURE 1

MFN 09-747

Response to Portion of NRC RAI Letter No. 384

Related to ESBWR Design Certification Application

DCD Tier 2 Section 3.8 – Seismic Category I Structures

RAI Number 3.8-129

NRC RAI 3.8-129

During the staff 's review of DCD Revision 6 changes, the staff noticed the following:

Section 3.8:

> *Change Item 216: In DCD Section 3.8.4.3.1.3, missing a * for [The safety-related steel …]* to designate Tier 2* information.*
>
> *Change Item 216: In DCD Figure 3.8-1, the [ ]* should apply to the entire Figure. This intention is not clear the way it is inserted along an empty line in the figure.*
>
> *Change Item 226: In DCD Section 3.8.3.6.1, the following designation was inserted for some of the materials: "[JDxxxx]" Why was this done and why only for some of the materials?*
>
> *Change Item 237: In DCD Section 3.8.4.3.4, the Tier 2* explanation should be a footnote and not part of the text of the paragraph.*

Appendix 3G

> *Change Item 64: In Description of Change – GEH to confirm that "Figure further revised in response to RAI 3.8-96 S04" should be identified as "Table further revised in response to RAI 3.8-94 S04."*

[Via Reference 1 (below) the NRC staff also]… *identified a few more editorial inaccuracies in the DCD Rev.6 changes for Section 3.7. During one of our past telephone calls, GEH indicated that they are aware of some editorial inaccuracies in Rev.6, and they are going to fix them. However, it may be good to send these to GEH as these may help them when they fix other editorial corrections already communicated to them for Section 3.8. These are as follows:*

> *"Section 3.7, Change Items 181, 182, 183, and 184: In each of the new DCD Subsections 3.7.2.8.1 through 3.7.2.8.4, for the effect of structure-soil-structure interaction with adjacent structures, Subsection 3A.8.1 is referenced. The correct reference is to Subsection 3A.8.11 for all four subsections.*
>
> *Section 3.7, Change Item 187: DCD Section 3.7.3.5 refers to RG 1.61 and is consistent with the proposed markup in the RAI 3.7-74 response. However, RG 1.61, Revision 1, should be referenced. GEH has committed to Revision 1 of RG 1.61.*
>
> *Appendix 3A, Change Item 2: Per RAI 3.7-77 the entire Section 3A.5 should be Tier 2*. Therefore,]* at the end of the Section 3A.5 introductory paragraph needs to be removed. The existing]* at the end of 3A.5.2 then designates all of Section 3A.5 as Tier 2*.*
>
> *Appendix 3A, Change Item 10: Table 3A.6-1 summarizes all the soil cases analyzed. Case (FC-1), for FWSC with layered soil and cracked properties, is the last one listed in the table, making a total of six layered cases for the FWSC. The*

first paragraph of Section 3A.6 identifies five layered cases for the FWSC. For consistency, "five' should be changed to "six" in the first paragraph of Section 3A.6."

Reference 1: NRC E-Mail of November 04, 2009 @ 4:50 PM ET between Chakrabarti, Samir; Cruz, Zahira, (Cc: Jeng, David; Morante, Richard J; Braverman, Joseph I; Hawkins, Kimberly; Cubbage, Amy)

GEH Response

Editorial inaccuracies identified by the NRC will be corrected in DCD Revision 7. Other inaccuracies identified by GEH will also be corrected in DCD Revision 7. The corrections are as follows:

The missing asterisk "*" in 3.8.4.3.1.3 will be inserted after the Tier 2* closing bracket.

The opening bracket "[" for DCD Figure 3.8-1 will be repositioned to clearly show the entire figure is included as a Tier 2* designation.

The "[JDxxxx]" will be removed from 3.8.3.6.1 as requested. Other word processing software annotation bleed throughs were also found in 3.8.3.6.3 and 3.8.3.6.4 and these will also be removed and thus corrected.

The note for Tier 2* in DCD Subsection 3.8.4.3.4 will be repositioned to a footnote in that subsection.

GEH reviewed DCD Section 3G change list item 64: "Figure further revised in response to RAI 3.8-96 S04" and found that the sentence should <u>not</u> have been included in change list item 64. Thus there is an error in the DCD Section 3G change list item 64 and only the first sentence [Changed "Stress" to "Pressure" in response to RAI 3.8-94 S04] is correct. The change list for DCD Revision 6 will not be reused or revised in DCD Revision 7; therefore no changes will be made to correct the DCD Rev. 6 Section 3G change list at this time.

DCD Subsections 3.7.2.8.1 to 3.7.2.8.4 will be revised to correct the DCD Subsection reference from 3A.8.1 to 3A.8.<u>11</u>.

DCD Subsection 3.7.3.5 will be revised to include "Revision 1" after RG 1.61 in the first sentence. GEH does not normally insert the revision level status in the body of the DCD unless historical revisions are being used in place of the revision specifically committed to in DCD chapter one Table 1.9-21. In DCD Table 1.9-21, RG-1.61 has an applicable Revision 1, issued date 03/2007 for the standard ESBWR.

The Tier 2* closure bracket and asterisk "]*" at the end of DCD Section 3A.5 will be removed so all of Section 3A.5 and the subsections will be clearly designated as Tier 2*. The opening bracket was moved from the title to the text so it did not appear in the chapter index.

DCD Section 3A.6 for FWSC with layered soil and cracked properties has in Table 3A.6-1 a total of six layered cases for the FWSC, but the first paragraph of DCD Section 3A.6 identifies five layered cases for the FWSC. For consistency, "five" will be changed to "six" in the first paragraph of Section 3A.6. The opening bracket was moved from the title to the text so it did not appear in the chapter index.

DCD Table 1.9-22 has a Tier 2* note on Page 1.9-126 of DCD Revision 6 with NRC as NCR. This will be corrected to NRC.

DCD Impact

Markups of the proposed DCD changes are included in this letter.

Enclosure 2

MFN 09-747

Response to Portion of NRC Request for

Additional Information Letter No. 384

Related to ESBWR Design Certification Application

DCD Markup for RAI Number 3.8-129

these structures, systems or components is equivalent to that of Seismic Category I structures, systems or components. SSCs in this category are classified as Seismic Category II, except the Radwaste Building.

The following subsections describe the seismic analysis methodology and design acceptance criteria for the Radwaste Building and Seismic Category II Buildings to preclude any adverse interaction with Seismic Category I structures.

3.7.2.8.1 Turbine Building

[*The Turbine Building is a Seismic Category II structure that is adjacent to the Reactor Building. The method of analysis of the Turbine Building is the same as a Seismic Category I structure including the loading cases and acceptance criteria as shown in Tables 3.8-15 and 3.8-16. The mathematical model of the structural systems for seismic analysis is either a stick model or a finite element model using the procedures in accordance with Subsection 3.7.2.3. The soil-structure interaction (SSI) analysis is performed using the soil spring/dashpot approach or the finite element approach in accordance with Appendix 3A. The generic uniform site properties are shown in Table 3A.3-1 and the layered site properties are shown in Table 3A.3-3. The effect of structure-soil-structure interaction with adjacent Seismic Category I structures is performed in the same manner as described in Subsection 3A.8.11. Seismic input motions are based on the single envelope design response spectra as defined in Table 3.7-2 with the applicable scale factor applied at the foundation level, at the bottom of the base slab.*

The Turbine Building location is shown in Figure 1.1-1. The building height is shown in Figure 1.2-19. The seismic gaps between the Turbine Building and the Reactor Building are no less than the calculated maximum relative displacements between the two buildings during SSE event, considering out-of-phase motion.]*

Text sections that are bracketed and italicized with an asterisk following the brackets are designated as Tier 2. Prior NRC approval is required to change.

3.7.2.8.2 Radwaste Building

[*The RW is designed in accordance with RG 1.143 Classification RW-IIa. The earthquake loading for the RW is full SSE instead of 1/2 SSE as shown in RG 1.143. Systems, structures and components classified as RW-IIa that are housed within the RW are designed to 1/2 SSE.*

Analysis of the RW is performed in the same manner as a Seismic Category I structure including the loading cases and acceptance criteria as shown in Tables 3.8-15 and 3.8-16. The mathematical model of the structural systems for seismic analysis is either a stick model or a finite element model using the procedures of Subsection 3.7.2.3. The SSI analysis is performed using the soil spring/dashpot approach or the finite element approach in accordance with Appendix 3A. The generic uniform site properties are shown in Table 3A.3-1 and the layered site properties are shown in Table 3A.3-3. The effect of structure-soil-structure interaction with adjacent Seismic Category I structures is performed in the same manner as described in Subsection 3A.8.11. Seismic input motions are based on the single envelope design response spectra as defined in Table 3.7-2 with the applicable scale factor, applied at the foundation level, at the bottom of the base slab.

The RW location is shown in Figure 1.1-1. It is located at least 10 meters from the RW. The building height is shown in Figure 1.2-25.]*

Text sections that are bracketed and italicized with an asterisk following the brackets are designated as Tier 2. Prior NRC approval is required to change.

3.7.2.8.3 Service Building

[*The Service Building is a Seismic Category II structure that is adjacent to the Reactor Building and the Fuel Building. The method of analysis of the Service Building is the same as a Seismic Category I structure including the loading cases and acceptance criteria as shown in Tables 3.8-15 and 3.8-16. The mathematical model of the structural systems for seismic analysis is either a stick model or a finite element model using the procedures of Subsection 3.7.2.3. The SSI analysis is performed using the soil spring/dashpot approach or the finite element approach in accordance with Appendix 3A. The generic uniform site properties are shown in Table 3A.3-1 and the layered site properties are shown in Table 3A.3-3. The effect of structure-soil-structure interaction with adjacent Seismic Category I structures is performed in the same manner as described in Subsection 3A.8.11. Seismic input motions are based on the single envelope design response spectra as defined in Table 3.7-2 with the applicable scale factor, applied at the foundation level, at the bottom of the base slab.*

The Service Building location is shown in Figure 1.1-1. The seismic gaps between the Service Building and the Reactor/Fuel Building are no less than the calculated maximum relative displacements between the two buildings during an SSE event, considering out-of-phase motion.]*

Text sections that are bracketed and italicized with an asterisk following the brackets are designated as Tier 2. Prior NRC approval is required to change.

3.7.2.8.4 Ancillary Diesel Building

[*The Ancillary Diesel Building is a Seismic Category II structure. It houses the Ancillary Diesel Generators that are classified as Criterion B under the Regulatory Treatment of Non-Safety Systems (see Section 19A). The method of analysis of the Ancillary Diesel Building is the same as a Seismic Category I structure including the loading cases and acceptance criteria as shown in Tables 3.8-15 and 3.8-16. The mathematical model of the structural systems for seismic analysis is either a stick model or a finite element model using the procedures of Subsection 3.7.2.3. The soil-structure interaction (SSI) analysis is performed using the soil spring/dashpot approach or the finite element approach in accordance with Appendix 3A. The generic uniform site properties are shown in Table 3A.3-1 and the layered site properties are shown in Table 3A.3-3. The effect of structure-soil-structure interaction with adjacent Seismic Category I structures is performed in the same manner as described in Subsection 3A.8.11. Seismic input motions are based on the single envelope design response spectra as defined in Table 3.7-2 with the applicable scale factor applied at the foundation level, bottom of the base slab.*

The Ancillary Diesel Building location is shown in Figure 1.1-1. It is located at least 15.2 meters from the Fuel Building.]*

- If the equipment has free-end overhang span whose flexibility is significant compared to the center span, a mass is lumped at the overhang span.
- [*When equipment is concentrated between two existing nodes located between two supports in a finite element model, a new node is created at that location. Alternatively, the equipment mass can be concentrated at the nearest node to either side which tends to shift the natural frequency to the higher amplification region of the input motion response spectrum. When the approximate location of the equipment mass is shifted toward the mid-span between the supports the natural frequency is lowered and when the approximate location is shifted toward either support the natural frequency is increased. Moving the natural frequencies of the equipment into the higher amplification region of the excitation thereby conservatively increases the equipment response level.*

  Similarly, in the case of live loads (mobile) and variable support stiffness, the location of the load and the magnitude of the support stiffness are chosen to lower the system natural frequencies. Similar to the above discussion, this ensures conservative dynamic responses because the lowered equipment frequencies tend to be shifted to the higher amplification range of the input motion spectra. If not, the model is adjusted to give more conservative responses.]*

Text sections that are bracketed and italicized with an asterisk following the brackets are designated as Tier 2. Prior NRC approval is required to change.

3.7.3.3.3 Modeling of Special Engineered Pipe Supports

[*Special engineered pipe supports are not used.*]*

Text sections that are bracketed and italicized with an asterisk following the brackets are designated as Tier 2. Prior NRC approval is required to change.

3.7.3.4 Basis for Selection of Frequencies

Where practical, in order to avoid adverse resonance effects, equipment and components are designed/selected such that their fundamental frequencies are less than half or more than twice the dominant frequencies of the support structure. Moreover, in any case, the equipment is analyzed or tested or both to demonstrate that it is adequately designed for the applicable loads considering both its fundamental frequency and the forcing frequency of the applicable support structure.

3.7.3.5 Analysis Procedure for Damping

[*Damping values for equipment and piping are shown in Table 3.7-1 and are consistent with RG 1.61, Revision 1.*]* For ASME B&PV Code, Section III, Division 1 Class 1, 2, and 3, and ASME B31.1 piping systems, alternative damping values specified in Figure 3.7-37 are used. For systems made of subsystems with different damping properties, the analysis procedures described in Subsection 3.7.2.13 are applicable.

* Text sections that are bracketed and italicized with an asterisk following the brackets are designated as Tier 2*. Prior NRC approval is required to change.

3A.5 [*SOIL-STRUCTURE INTERACTION ANALYSIS METHOD*

*[The seismic analysis for uniform sites is performed using the program DAC3N with the sway-rocking SSI model without embedment. The seismic analysis for layered sites is performed using the program SASSI2000 with the finite elements for modeling the SSI with embedment. SASSI2000 analysis is also performed for uniform sites with embedment for the purpose of obtaining more realistic interface loads with the foundation medium for use in the foundation stability evaluation.]**

3A.5.1 DAC3N Analysis Method

The analysis model is a lumped mass-beam model with soil springs. The structural models are described in Subsection 3.7.2, and in Section 3A.7 in more detail.

To account for SSI effect, sway-rocking base soil springs are attached to the structural model. The base spring is evaluated from vibration admittance theory, based on three-dimensional wave propagation theory for uniform half-space soil. For this evaluation, soil material damping values are conservatively neglected. Though the spring values consist of frequenc- dependent real and imaginary parts, they are simplified and replaced with frequency-independent soil spring K_c*, and damping coefficient* C_c*, respectively, for the time history analysis solved in the time domain. The method used to obtain the equivalent frequency-independent soil stiffness and damping is illustrated in Figure 3A.5-1. The calculated* K_c *and* C_c *values are tabulated in Tables 3A.5-1 through 3A.5-3 for the RB/FB complex, CB and FWSC, respectively.*

The effect of lateral soil/backfill on embedded foundations is conservatively accounted for by applying the control motion directly at the foundation level. Dynamic lateral soil pressures are calculated separately and considered in the design of external walls, using the elastic solution procedures in Subsection 3.5.3.2 of ASCE 4-98.

Because the three component ground motion time histories are statistically independent as described in Subsections 3.7.1.1.2 and 3.7.1.1.3, they are input simultaneously in the response analysis using the time history method of analysis solved by direct integration. The numerical integration time step is 0.002 sec. for the RG 1.60 input motion and 0.001 sec. for the North Anna site input motion and the single envelope input motion. Structural responses in terms of accelerations, forces, and moments are computed directly. Floor response spectra (FRS) are obtained from the calculated response acceleration time histories (Subsection 3.7.2.5).

3A.5.2 SASSI2000 Analysis Method

For the seismic analysis of layered and uniform sites, the linear finite element computer program SASSI2000 is used. The program uses finite elements with complex moduli for modeling the structure and foundation properties and is based on the subtraction method and the frequency domain complex response method. The lumped mass-beam model described in Subsection 3A.5.1 is coupled with finite element soil model. The model details are described in Section 3A.7. Structural responses in terms of accelerations, forces and moments are computed directly. FRS are obtained from the calculated response acceleration time histories.

The SSI analyses for the three directional earthquake components are performed separately. The maximum co-directional responses to each of the three earthquake components are combined using algebraic sums in the time domain.]*

E' = SSE loads as defined in Section 3.7 including SSE-induced hydrodynamic pressures in pools. The impulsive and convective pressures may be combined by the SRSS method.

T_o = Thermal effects — load effects induced by normal thermal gradients existing through the RB wall and roof. Both summer and winter operating conditions are considered. In all cases, the conditions are considered of long enough duration to result in a straight line temperature gradient. The temperatures are listed in Table 3.8-10. The stress free temperature for the design is 15.5°C (59.9°F).

T_a = Thermal effects (including T_o) which may occur during a design accident.

H = Loads caused by static or seismic earth pressures and water in soil.

3.8.4.3.1.2 Load Combinations for Concrete Members

For the load combinations in this subsection, where any load reduces the effects of other loads, the corresponding coefficient for that load is taken as 0.9, if it can be demonstrated that the load is always present or occurs simultaneously with the other loads. Otherwise, the coefficient for that load is taken as zero.

[*The safety-related concrete structure is designed using the loads, load combinations, and load factors listed in Table 3.8-15. Because a number of concrete structures in the RB are integrally connected with the concrete containment, the load combinations for the concrete containment, which are listed in Table 3.8-2, are additionally considered in the design of the RB concrete structures.*]* The maximum co-directional responses to each of the excitation components for seismic loads are combined by the SRSS method as described in Subsection 3.8.1.3.6.

Text sections that are bracketed and italicized with an asterisk following the brackets are designated as Tier 2. Prior NRC approval is required to change.

3.8.4.3.1.3 Load Combinations for Steel Members

[*The safety-related steel structure is designed using the loads, load combinations, and load factors listed in Table 3.8-16.*]* The maximum co-directional responses to each of the excitation components for seismic loads are combined by the SRSS method as described in Subsection 3.8.1.3.6.

In all these load combinations, both cases of L having its full value or being completely absent are checked.

Text sections that are bracketed and italicized with an asterisk following the brackets are designated as Tier 2. Prior NRC approval is required to change.

3.8.4.3.2 Control Building

[*Refer to the loads, notations, and combinations established in Subsection 3.8.4.3.1, except that fluid pressure F, accident pressure P_a, and pipe break loads Y_r, Y_j, Y_m do not exist.*]* In addition, because the CB is structurally separated from the concrete containment, the load combinations for the concrete containment do not apply to the CB design. The live loads and temperature loads are as follows:

- All concrete floors except for HVAC room – 4.8 kPa (100 psf)

- Concrete floors in HVAC room – 2.9 kPa (60 psf)
- Concrete roof – 2.9 kPa (60 psf)
- Construction live load on floor framing in addition to dead weight of floor – 2.4 kPa (50 psf)

The temperatures during normal operating conditions are shown in Table 3.8-11. The temperatures during abnormal operating conditions are shown in Table 3H-10 and are associated with a postulated loss of HVAC function.

Text sections that are bracketed and italicized with an asterisk following the brackets are designated as Tier 2. Prior NRC approval is required to change.

3.8.4.3.3 Fuel Building

[*Refer to the loads, notations, and combinations established in Subsection 3.8.4.3.1, except that fluid pressure F, accident pressure P_a, and pipe break loads Y_r, Y_j, Y_m do not exist.*]* The accident thermal load, T_a, includes the thermal effects of boiling water at 104ºC (219ºF) in the spent fuel pool which may occur due to loss of FAPCS cooling function. The live loads and temperature loads are as follows:

- All concrete floors except for HVAC room – 4.8 kPa (100 psf)
- Concrete floors in HVAC room – 2.9 kPa (60 psf)
- Concrete roof – 2.9 kPa (60 psf)
- Construction live load on floor framing in addition to dead weight of floor – 2.4 kPa (50 psf)

The temperatures during normal operating conditions are shown in Table 3.8-12.

The spent fuel pool structure (reinforced concrete floor and walls, and steel liner) is evaluated for loads imposed by the spent fuel storage racks in combination with other applicable loads in accordance with the load combinations and acceptance criteria defined in Table 3.8-15. Table 3.8-15 is also applicable to steel liners except that the load factors in load combinations are 1.0 and acceptance criteria are in accordance with ASME Section III Division 2 CC-3700.

Text sections that are bracketed and italicized with an asterisk following the brackets are designated as Tier 2. Prior NRC approval is required to change.

3.8.4.3.4 Radwaste Building

[*Loads and load combinations for the RW are described in Subsection 3.7.2.8.2.*]*

Text sections that are bracketed and italicized with an asterisk following the brackets are designated as Tier 2. Prior NRC approval is required to change.

3.8.4.3.5 Firewater Service Complex

[*Refer to the loads, notations, and combinations established in Subsection 3.8.4.3.1, except that fluid pressure F, accident pressure P_a, accident thermal T_a, accident pipe reactions R_a and pipe break loads Y_r, Y_j, Y_m do not exist.*]* In addition, because the FWSC is structurally separated

3A.6 [*SOIL-STRUCTURE INTERACTION ANALYSIS CASES*

[*To establish design envelopes of seismic responses of the RB/FB complex, SSI analyses are performed for 34 cases of uniform sites and six cases of layered sites. Similarly for the CB, SSI analyses are performed for 14 cases of uniform sites and six cases of layered sites. SSI analyses for the FWSC are performed for seven cases of uniform sites and ~~five~~six cases of layered sites. This is summarized in Table 3A.6-1.*

The enveloping results are obtained from the responses of all SSI cases to cover a wide range of conditions.]*

Text sections that are bracketed and italicized with an asterisk following the brackets are designated as Tier 2. Prior NRC approval is required to change.

3.8.3.6 Materials, Quality Control, and Special Construction Techniques

3.8.3.6.1 Diaphragm Floor

[*The materials conform to all applicable requirements of ANSI/AISC N690 and ACI 349 and comply with the following:*

Item	*Specification*
Top and bottom plate	*ASTM ~~[JD1089]~~A-709 HPS 70W**
Support beam	*ASTM ~~[JD1091]~~A-709 HPS 70W**
Internal stiffeners	*ASTM A-36~~[JD1093]~~ or A-709 HPS 70W**
Concrete fill	*f 'c = 34.5 MPa (5000 psi)*
Stainless cladding for wetted surface of top plate	*ASTM A-240 Type 304L*
**ASME Code Case N-763~~[JD1095]~~*	

Different material choices are available from the specifications listed above.]*

Text sections that are bracketed and italicized with an asterisk following the brackets are designated as Tier 2. Prior NRC approval is required to change.

3.8.3.6.2 Reactor Pressure Vessel Support Bracket

[*The steel plate materials conform to all applicable requirements of ANSI/AISC N690 and comply with ASTM A-516 Gr. 70 or A-709 HPS 70W (ASME Code Case N-763). Materials are chosen depending on the thickness of each part.*]*

Text sections that are bracketed and italicized with an asterisk following the brackets are designated as Tier 2. Prior NRC approval is required to change.

3.8.3.6.3 Reactor Shield Wall

[*The materials conform to all applicable requirements of ANSI/AISC N690 and comply with the following:*

Materials are chosen depending on the thickness of each part. ~~*[JD1103]*~~

Item	*Specification*
Cylinder Plate	*ASTM A-516 Gr. 70 or ASTM A-668 Gr. F or Gr. G ~~[JD1104]~~or A-709 HPS 70W (ASME Code Case N-763)~~[JD1107]~~*

Different material choices are available from the specification listed above.]*

Text sections that are bracketed and italicized with an asterisk following the brackets are designated as Tier 2. Prior NRC approval is required to change.

3.8.3.6.4 Vent Wall

[*The materials conform to all applicable requirements of ANSI/AISC N690 and ACI 349 and comply with the following:*

Item	*Specification*
Inner and outer cylinders (excluding the portions submerged in the suppression pool)	*ASTM ~~[JD1110]~~A-709 HPS 70W**
Internal stiffeners	*ASTM A-36~~[JD1112]~~ or A-709 HPS 70W***
Concrete fill	*f 'c= 34.5 MPa (5000 psi)*
Outer shell submerged in the suppression pool	*ASTM ~~[JD1114]~~A-709 HPS 70W* with A-240 Type 304L clad*
Vent Pipe	*ASTM A-240 Type 304L*
** ASME Code Case N-763~~[JD1116]~~*	

Different material choices are available from the specifications listed above.]*

Text sections that are bracketed and italicized with an asterisk following the brackets are designated as Tier 2. Prior NRC approval is required to change.

3.8.3.6.5 Gravity Driven Cooling System Pool

[*The materials conform to all applicable requirements of ANSI/AISC N690 and comply with the following:*

Item	***Specification***
Pool wall plate	*ASTM A-709 HPS 70W* with A-240 Type 304L Clad*
Structural support beam	*ASTM A-709 HPS 70W*, ASTM A-709 HPS 70W* with A-240 Type 304L Clad*
Stiffeners	*ASTM A-36*

** ASME Code Case N-763*]*

Text sections that are bracketed and italicized with an asterisk following the brackets are designated as Tier 2. Prior NRC approval is required to change.

3.8.3.6.6 Miscellaneous Platforms

[*The materials conform to all applicable requirements of ANSI/AISC N690 for safety-related and AISC-ASD or AISC-LFRD for nonsafety-related and comply with the following:*

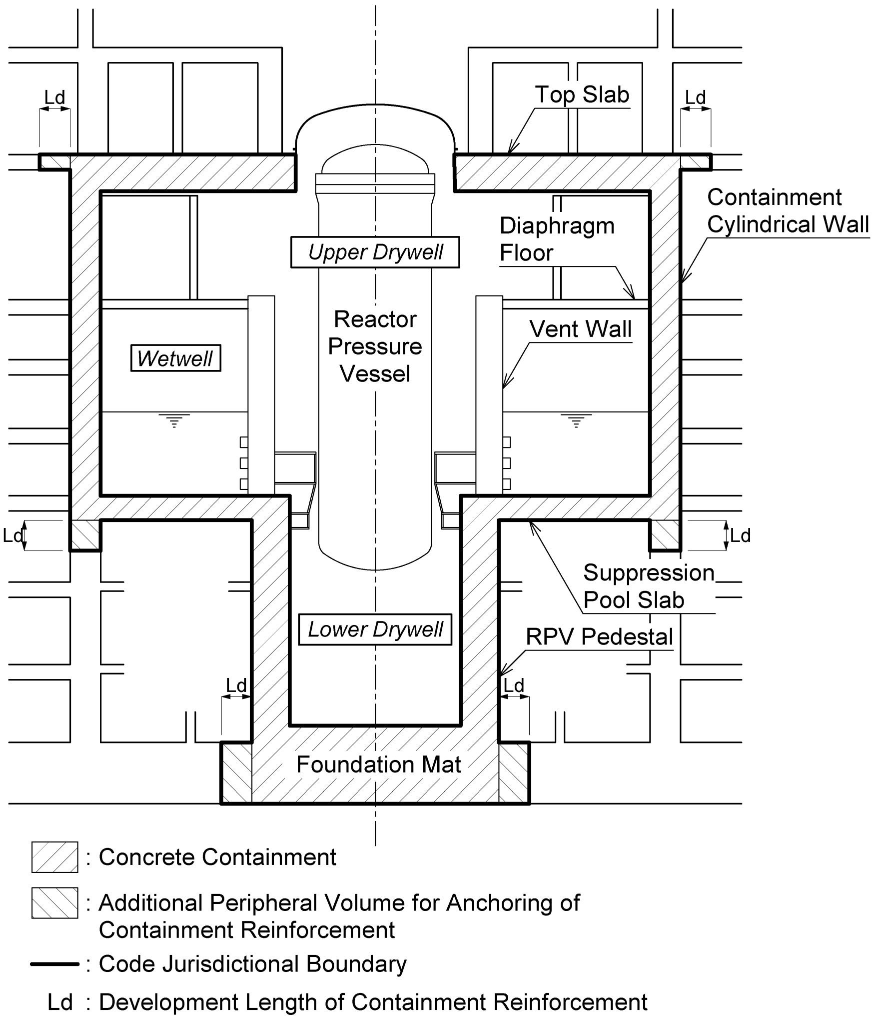
Table 1.9-22

Industrial Codes and Standards[1] Applicable to ESBWR

Code or Standard Number	Year	Title
797	2004	UL Standard for Safety Electrical Metallic Tubing – Steel, 8th Edition
845	1995	UL Standard for Safety for Motor Control Centers, 4th Edition (Reprint with Revisions through Including April 5, 2004)
875	2004	UL Standard for Safety Electric Dry-Bath Heaters, 8th Edition
886	1994	UL Standard for Safety Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations, 10th Edition (Reprint with Revisions through and Including April 13, 1999)
900	2004	UL Standard for Safety Air Filter Units, 7th Edition
924	1995	UL Standard for Safety Emergency Lighting and Power Equipment, 8th Edition (Reprint with revisions through and Including July 11, 2001)
1096	1988	UL Standard for Safety Electric Central Air Heating Equipment, 4th Edition
1950	1995	UL Standard for Safety Information Technology Equipment, Including Electrical Business Equipment; Third Edition
1995	2005	UL Standard for Heating and Cooling Equipment, 3rd Edition
Others		
CMAA70	2004	Crane Manufacturers Association of America, Specification No. 70
DEMA	—	Standard Practices for Low and Medium Speed Stationary Diesel and Gas Engines
Factory Mutual (FM)	—	Factory Mutual Approval Guide
390.02	1964	Gear Classification Manual by AGMA
HMR No. 52	1982	National Weather Service Publication: "Application of Probable Maximum Precipitation Estimates United States East of the 105th Meridan"
(Deleted)		
NIOSH 86-113	1986	National Institute for Occupational Safety and Health, "Criteria for a Recommended Standard … Occupational Exposure to Hot Environments (Revised Criteria 1986)," NIOSH Publication No. 86-113, April 1986
SNT-TC-1A	1992	Recommended Practice for Non-Destructive Testing by American Society for Nondestructive Testing (Note 2001 version exists)
TEMA	1999	Standards of Tubular Exchanger Manufacturers Association, Eighth Edition
—	2000	Aluminum Design Manual by Aluminum Association

Notes:
Other Organizations that are Referenced Without Specific Standards Listed:
Department of Transportation (DOT)
Federal Aviation Administration (FAA)
Federal Occupational Safety and Health Administration (OSHA)
Table sections that are bracketed and italicized with an asterisk following the brackets are designated as Tier 2. Prior NRC~~NCR~~ approval is required to change.

[



]*

Figure 3.8-1. Configuration of Concrete Containment

Figures that are bracketed with an asterisk following the brackets are designated as Tier 2. Prior NRC approval is required to change.